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TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT

MAINTENANCE MANUAL

RECOVERY VEHICLE, FULL TRACKED: MEDIUM, M88A1

NSN 2350-00-122-6826

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v	v
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WARNING

CARBON MONOXIDE POISOINING CAN BE DEADLY

CARBON MONXIDE IS A COLORLESS, ODORLESS, DEADLY POISONOUS GAS WHICH, WHEN BREATHED, DEPRIVES THE BODY OF OXYGEN AND CAUSES SUFFOCATION. EXPOSURE TO AIR CONTAMINATED WITH CARBON MONOXIDE PRODUCES SYMPTOMS OF HEADACHE, DIZZINESS, LOSS OF MUSCULAR CONTROL, APPARENT DROWSINESS, COMA. PERMANENT BRAIN DAMAGE OR DEATH CAN RESULT FROM SEVERE EXPOSURE.

IT OCCURS IN THE EXHAUST FUMES OF FUEL-BURNING HEATERS AND INTERNAL-COMBUSTION ENGINES AND BECOMES DANGEROUSLY CONCENTRATED UNDER CONDITIONS OF INADEQUATE VENTILATION. THE FOLLOWING PRECAUTIONS MUST BE OBSERVED TO INSURE THE SAFETY OF PERSONNEL WHENEVER THE PERSONNEL HEATER, MAIN, OR AUXILIARY ENGINE OF ANY VEHICLE IS OPERATED FOR MAINTENANCE PURPOSES OR TACTICAL USE.

1. DO NOT operate heater or engine of vehicle in an enclosed area unless it is ADEQUATELY VENTILATED.

2. DO NOT idle engine for long periods without maintaining ADEQUATE VENTILATION in personnel compartments.

3. DO NOT drive any vehicle with inspection plates, cover plates, engine compartment doors removed unless necessary for maintenance purposes.

4. BE ALERT at all times during vehicle operation for exhaust odors and exposure symptoms. If either are present, IMMEDIATELY VENTILATE personnel compartments. If symptoms persist, remove affected personnel from vehicle and treat as follows: expose to fresh air; keep warm; DO NOT PERMIT PHYSICAL EXERCISE; if necessary, administer artificial respiration.

THE BEST DEFENSE AGAINST CARBON MONOXIDE POISONING IS ADEQUATE VENTILATION.

WARNING

HIGH VOLTAGE

is used in the operation of some equipment.

SERIOUS INJURY

may result if personnel fail to observe safety precautions. Learn the areas containing high voltage in each piece of equipment. Be careful not to contact high voltage connections when installing or operating this equipment. Before working on electrical equipment, harnesses, battery cables or starter cables turn master switch to OFF position and disconnect battery ground cables.

OBSERVE THE WARNING NOTES THROUGHOUT THIS MANUAL.

WARNING

DO NOT STAND ON ENGINE DECK WHILE OPERATING THE BOOM.

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TECHNICAL MANUAL
NO. 9-2350-256-34-1

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WASHINGTON, DC, *28 January 1977*

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

RECOVERY VEHICLE, FULL TRACKED: Medium, M88A1 (NSN 2350-00-122-6826)

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CHAPTER 1

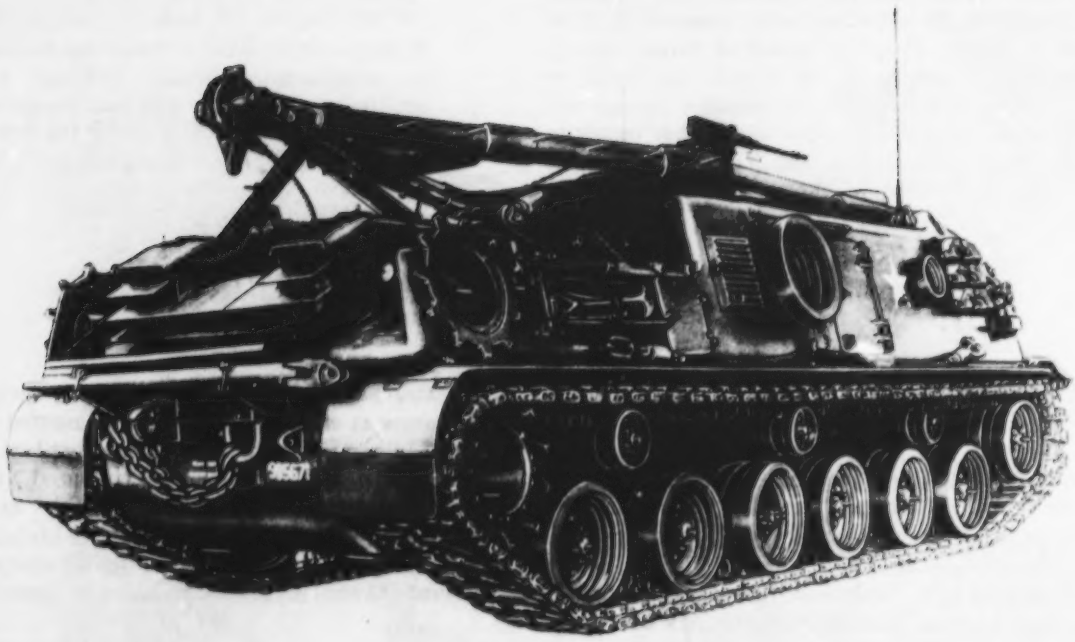
INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual contains instructions for direct and general support maintenance for the Recovery Vehicle, Full Tracked: Medium, M88A1 (fig. 1-1 and 1-2). It contains descriptions of and procedures for removal, disassembly, inspection, repair, assembly and test which are normally beyond the scope of repair at the using organizational level.

Figure 1-1. Recovery vehicle, full tracked: medium, M88A—left front view.



TA039242

Figure 1-2. Recovery vehicle, full tracked: medium, M88A1—right rear view.

b. Other publications pertinent to the operation, maintenance and repair of the Recovery Vehicle, Full Tracked: Medium, M88A1, are listed in appendix A.

c. The prescribed maintenance responsibilities will apply as reflected in the Maintenance Allocation Chart (TM 9-2350-256-20).

1-2. Forms, Records and Reports

a. General. Responsibility for the proper execution of forms, records and reports rests upon the commanding officer of all units maintaining this equipment. However, the value of accurate records must be fully appreciated by all persons responsible for their compilation, maintenance and use. Records, reports and authorized forms are normally utilized to indicate the type, quantity and condition of materiel to be inspected, to be repaired or to be used in repair. Properly executed forms convey authorization and serve as records for repair or replacement of materiel in the hands of troops and for delivery of materiel requiring further repair to shops in arsenals, depots, etc. The forms, records and reports establish the work required, the progress of the work within the shops and the stat of the materiel upon completion of repair.

b. Authorized Forms. No forms other than tho approved for the Department of the Army will used. For a complete listing of all forms refer to D Pam 310-2 and TM 38-750.

c. Field Report of Accidents. The repor necessary to comply with the Army safety progra are listed in AR 385-40. These reports are requir whenever accidents involving injury to personnel damage to materiel occur.

d. Report of Unsatisfactory Equipment a Materiels. Any suggestions pertinent to the i provement, safety or correction of unsatisfacto performance of equipment and materials are to reported on DA Form 2407 in accordance with i structions contained in TM 38-750.

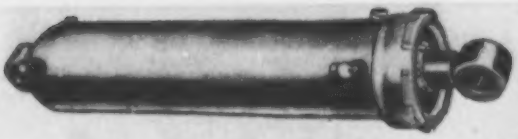
NOTE

Do not report all failures that occur. Report only repeated or recurrent failures or malfunctions which indicate unsatisfactory design or material. However, reports will always be made in the event that exceptionally costly equipment is involved.

Section II. DESCRIPTION AND DATA

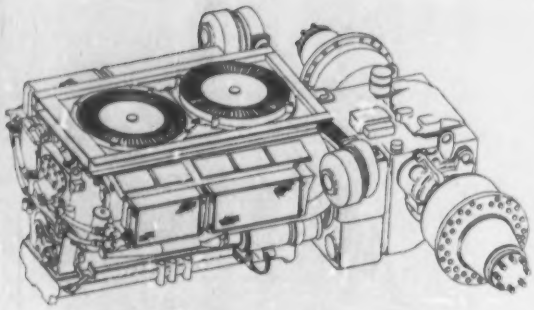
1-3. Description

a. General. The Recovery Vehicle, Full Tracked: Medium, M88A1 is a medium armored, full track laying, low silhouette vehicle that performs hoisting, winching and towing operations for tanks and other vehicles. The vehicle also supports medium and light tank units to effect battlefield recovery. Further detailed descriptions of the individual assemblies and components covered replacement and/or repair in this manual will found in pertinent chapters. General operating a maintenance descriptions are found in T 9-2350-256-10, Operator's Manual, and T 9-2350-256-20, Organizational Maintenan Manual. The general location of major componen assemblies and auxiliaries is shown in figure 1-3.

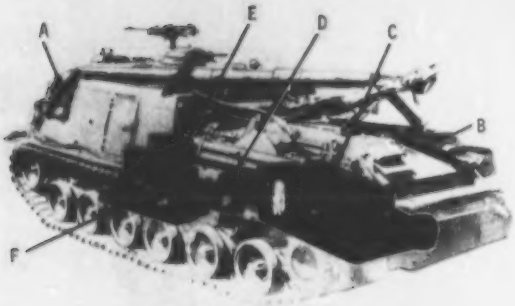


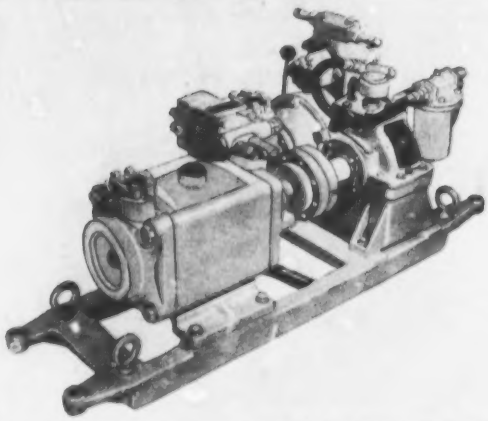
A. BOOM ACTUATING CYLINDERS.

B. BOOM STAYLINE ACTUATING CYLINDERS.

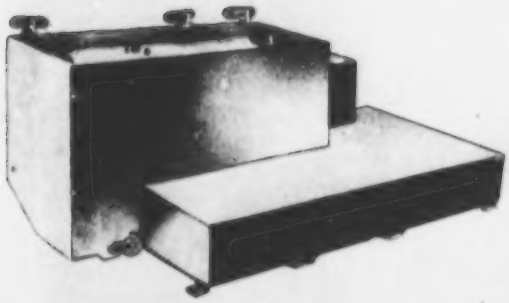


C. POWERPLANT.

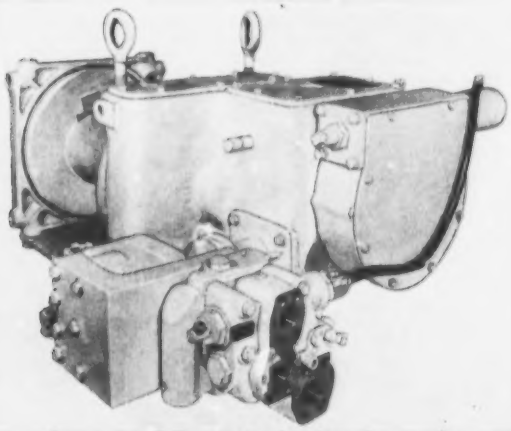




D. MECHANICAL TRANSMISSION AND MAIN HYDRAULIC PUMP.



F. FORWARD FUEL TANK.

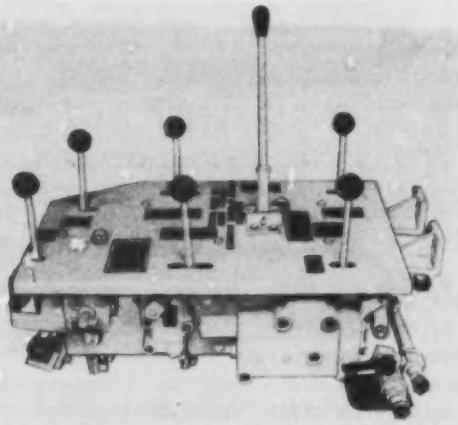


E. HOIST WINCH.

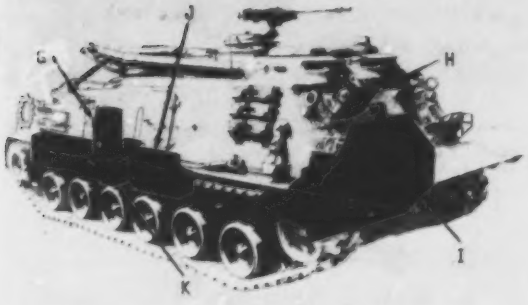
TA039243

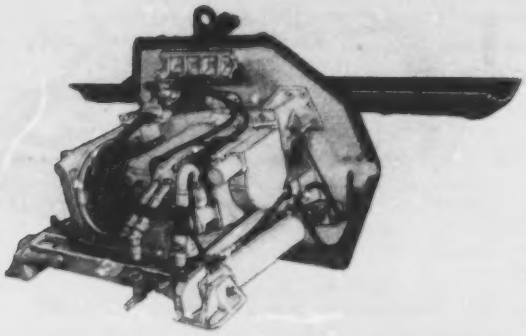
Figure 1-3. Location of major components, assemblies and auxiliaries (Sheet 1 of 7).

G. AUXILIARY POWER UNIT.

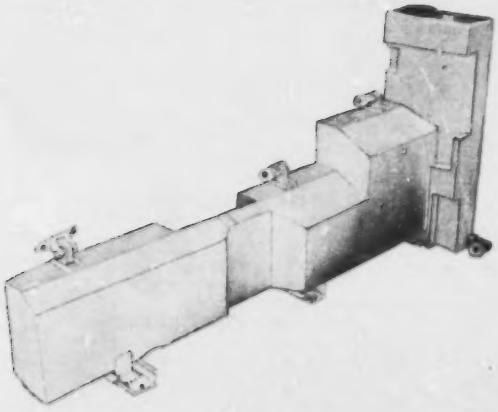


H. HYDRAULIC CONTROL PANEL (SUBPLATE).

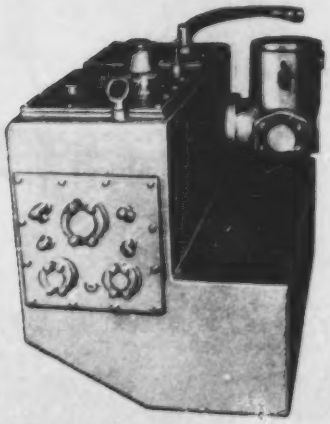




I. MAIN WINCH AND SPADE.



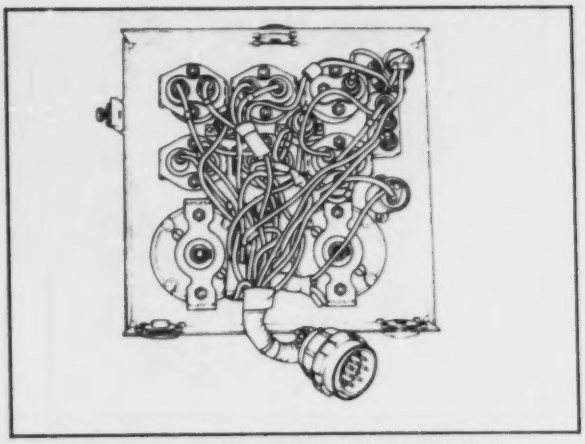
K. LEFT AND RIGHT FUEL TANKS.



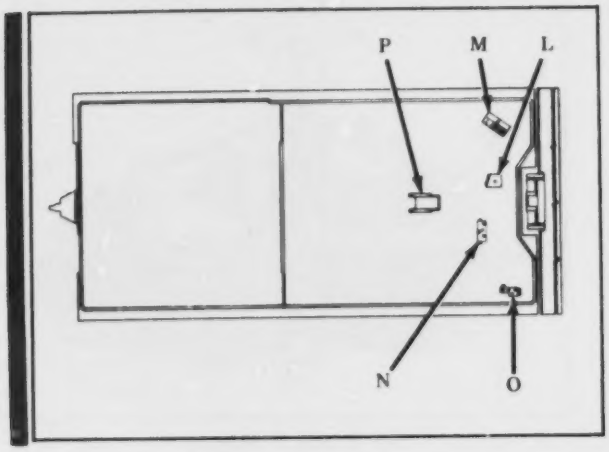
J. HYDRAULIC SYSTEM OIL TANK. TA039244

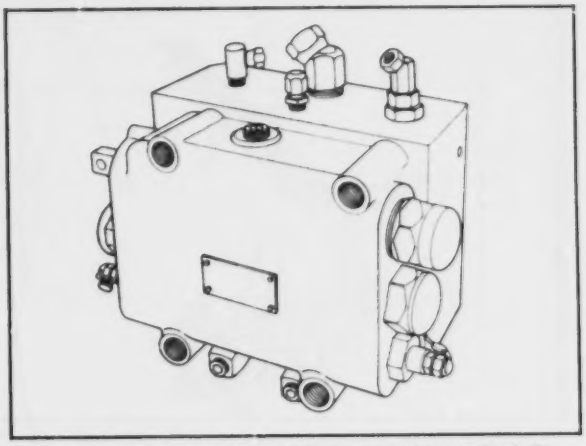
Figure 1-3. Location of major components, assemblies and auxiliaries (Sheet 2 of 7).

L. MAIN SWITCH PANEL WIRING HARNESS.

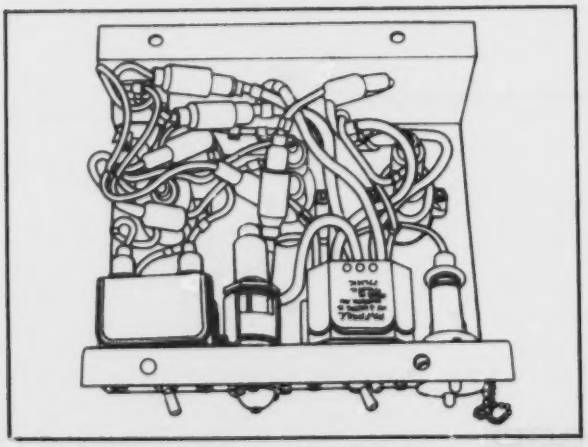


M. GAGE PANEL WIRING HARNESS.

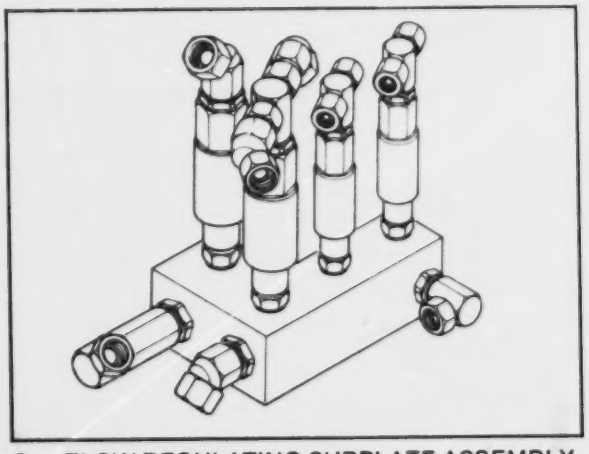




N. HYDRAULIC CONTROL VALVE (SPADE).



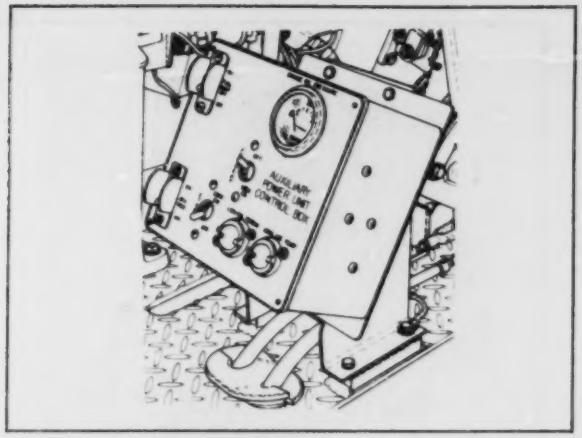
P. ACCESSORIES PANEL WIRING HARNESS.



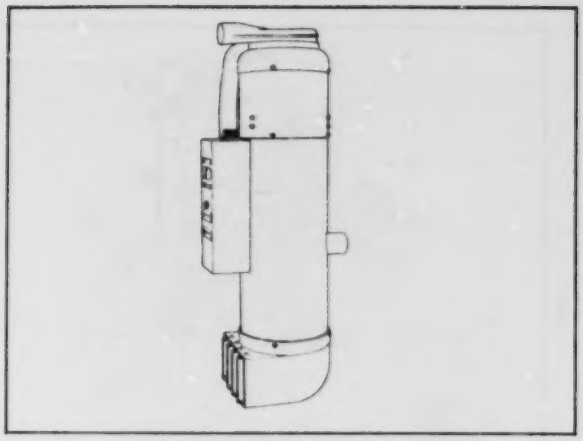
O. FLOW REGULATING SUBPLATE ASSEMBLY.

Figure 1-3. Location of major components, assemblies and auxiliaries (Sheet 3 of 7).

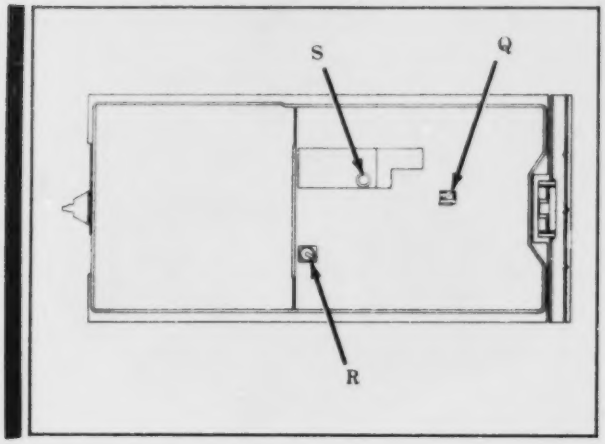
TA171778

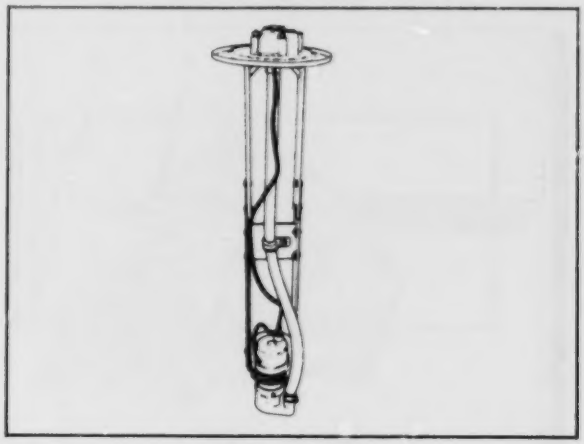


Q. AUXILIARY POWER UNIT CONTROL BOX.



R. PERSONNEL HEATER.



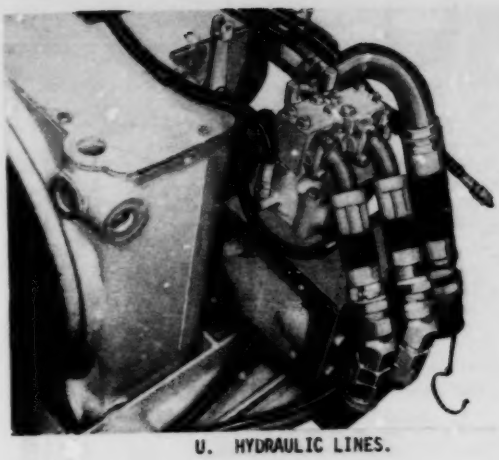


S. FUEL PUMP.

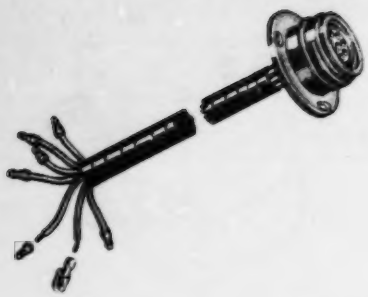
T. DELETED

Figure 1-3. Location of major components, assemblies and auxiliaries (Sheet 4 of 7).

TA171779



U. HYDRAULIC LINES.

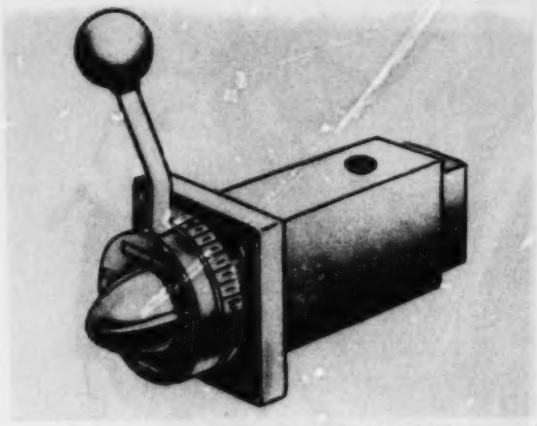


V. HULL WIRING HARNESS.

W. PRIMER PUMP.

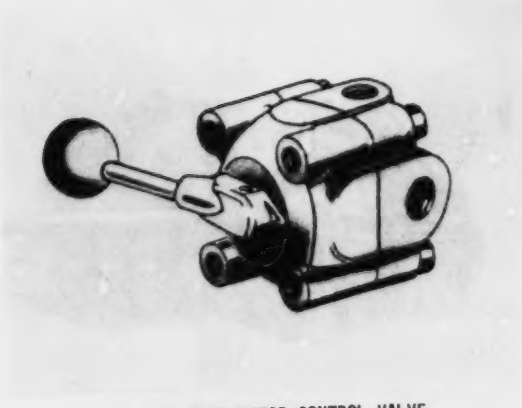
TA039247

Figure 1-3. Location of major components, assemblies, and auxiliaries (Sheet 5 of 7).

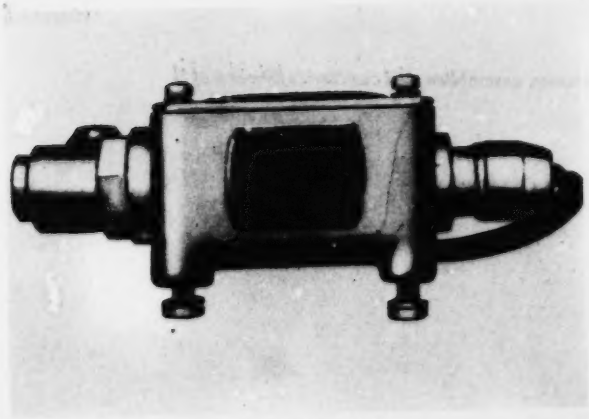


Y. ADJUSTABLE FLOW HYDRAULIC REGULATOR.

X. DELETED



Z. FUEL PUMP MOTOR CONTROL VALVE.

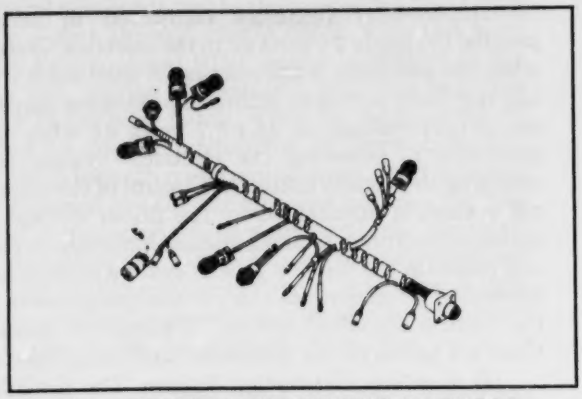


AB. PRESSURE SWITCH ASSEMBLY.

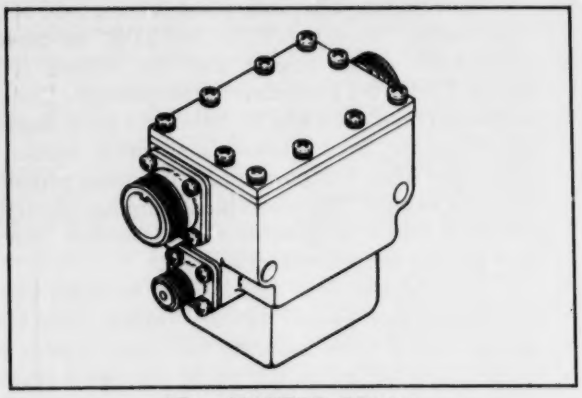
AA. BOOM LIMIT VALVE.

TA171306

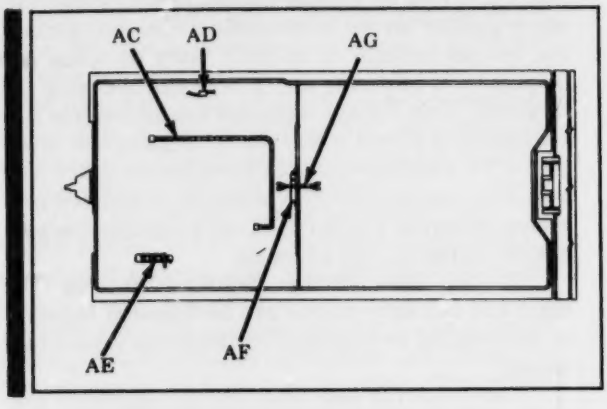
Figure 1-3. Location of major components, assemblies, and auxiliaries (Sheet 6 of 7).

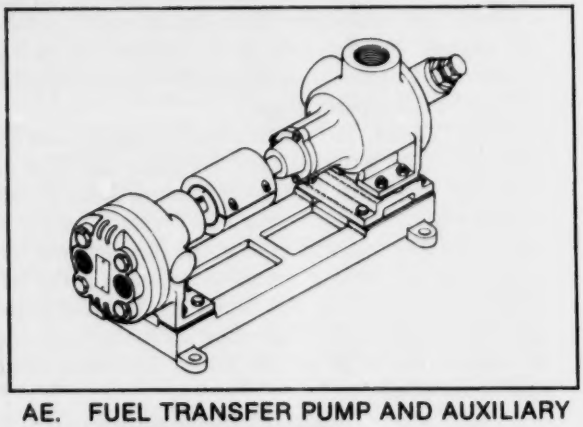


AC. POWERPLANT WIRING HARNESS.

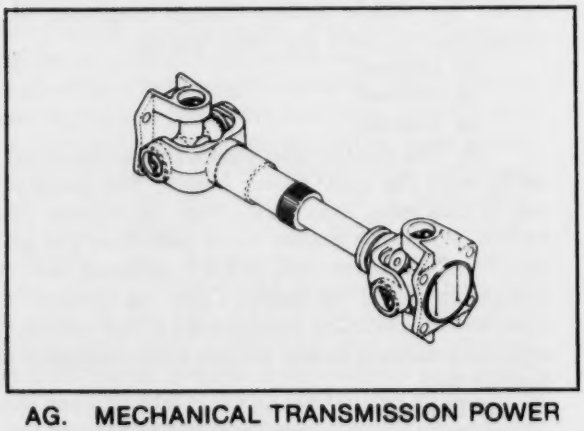


AD. MASTER RELAY.

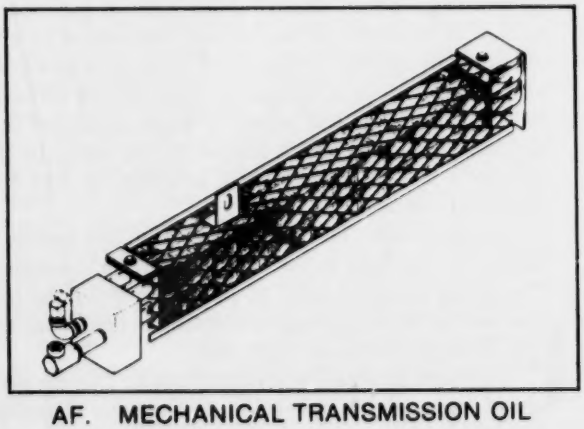




AE. FUEL TRANSFER PUMP AND AUXILIARY HYDRAULIC MOTOR.



AG. MECHANICAL TRANSMISSION POWER TAKEOFF SHAFT.



AF. MECHANICAL TRANSMISSION OIL COOLER.

Figure 1-3. Location of major components, assemblies and auxiliaries (Sheet 7 of 7).

TA171780

b. Powerplant. The powerplant is composed of the Continental Model AVDS-1790-2DR air-cooled, 12-cylinder, diesel engine and the Allison (GM) Model XT-1410-4 cross-drive transmission. The powerplant is removed and installed as a unit. Separation of engine from transmission center section is performed after the powerplant has been removed from the vehicle. The powerplant supplies electrical power through a generator and motive power through the output reduction units.

c. Fuel System. The fuel system includes liquid fuel (diesel) storage and delivery system. Fuel storage consists of three separate fuel tanks. Fuel is fed to the engine by an electric pump through a system of hoses and valves. Fuel is strained at the tank filler openings as the tanks are filled, and filtered through separate and renewable filter elements as it is fed to the engine. Combustion air is cleaned by two air cleaners and driven into the engine intake manifolds by two turbosuperchargers.

d. Fuel Tanks. All tanks are of a welded steel construction. The left rear tank contains the filler cap and filter assembly. Fuel level sending units are contained within the right rear and forward tanks. An electric fuel pump is located in the forward fuel tank sump cavity, allowing complete drainage of the tank before tank removal. All tanks are interconnected and shock mounted. Grounding straps are provided to assure discharge of any static electricity which might accumulate.

e. Fuel Pump. The electric fuel pump located in the forward fuel tank sump cavity is a centrifugal pusher-type pump designed for submerged operation. It is hermetically sealed and contains a 24-volt dc motor to operate the pump. A strainer is provided as an integral part of the pump assembly for efficient fuel filtering. The fuel pump is shock mounted in a support assembly which suspends the pump in the fuel tank and also provides a housing for fuel and electrical connections.

f. Purge Pump. The purge pump (fig. 3-8) handle is located on the floor to the left of the driver's position. The purge pump is used to pump air from the fuel lines and to facilitate engine starting in cold weather.

g. Vehicle Electrical Systems.

(1) *Main Engine Generator System.* During periods of main engine operation, the vehicle electrical system derives its power from a 300-ampere, 28-volt dc generator and is driven by the main engine. This generator also serves to charge the vehicle batteries during periods of main engine operation. The vehicle battery system consists of six 12-volt, 100-ampere-hour batteries connected in series-parallel to supply 24 volts dc to the electrical system when the generator is not running. A solid state voltage regulator serves to maintain a constant generator output voltage of 28 ± 0.7 volts dc when the generator is powering the electrical system and charging the vehicle batteries. Control of the electrical system is maintained by the driver through a series of instruments and switches mounted on control panels in the driver's area. A system of electrical harnesses interconnects the various components of the vehicle electrical system. Waterproof connections are provided for harnesses and components.

(2) *Auxiliary Generating System.* The auxiliary generating system consists of a dc voltage generator (fig. 4-1) driven by a diesel engine. A solid-state voltage regulator serves to maintain a constant generator output voltage of 28 ± 0.7 volts dc when the generator is powering the system and charging the batteries. This voltage regulator has an internal current limiting circuit which the APU generator interpole (APU regulator plug pin E) voltage to 0.48 ± 0.03 vdc. This corresponds to a nominally regulated generator output of 160 amps dc, with a maximum generator output of 180 amps dc.

(3) *New Dual Voltage Regulator System.* The main and auxiliary engine can be operated together or individually as desired to recharge the vehicle batteries.

(a) With the new dual voltage regulator system, during periods of cold weather starting, the auxiliary engine can now be started and left running to aid the vehicle battery charge condition, while attempting to start the main engine.

(b) Deleted.

(c) Deleted.

(d) Deleted.

(e) The master relay contacts are connected in series with the main power source. The energizing coil of this relay is in series with the master relay switch. When the master relay switch on the main switch panel is turned off, power is removed from the energizing coil of the master relay, its contacts are open and all electrical components of the vehicle except the personnel heater and the slave receptacle are deactivated.

(4) Deleted

(5) Deleted

(6) Bilge Pump Electrical System (fig. 2-13). The bilge pump is connected to the vehicle main power supply through a relay and circuit breaker by circuits 450A, 451A and 451B. The energizing (control) coil

of the relay is connected to the accessories panel bilge pump switch through circuit 450B. With this bilge pump switch closed (ON), power is applied to the relay coil, closing its contacts and thus applying power to the bilge pump. When the pump is not installed for deep water fording, its power cable (circuit 451B beneath crew compartment floor) is looped and fastened to a fire extinguisher tube and the connector is protected with a waterproof cap. The relay, circuit breaker and bilge pump are all located beneath the floor of the crew compartment. An indicator light on the accessories panel is energized simultaneously with the pump to indicate when the pump is operating.

(7) Harnesses. The cables and wires carrying the electrical circuits, serving the various components of the electrical system, are assembled into harnesses. These carry the interconnecting splices in protective covering and incorporate various types of terminals. These terminals make positive and secure electrical connections at the various points served by the harness and provide for easy connection and disconnection without splicing or soldering.

h. Transmission and Output Reduction Units. The Allison Model XT-1410-4 cross-drive transmission is a combined transmission and steering unit. It consists of a basic transmission unit package to which has been added the torque-converter package (front), steering-clutch packages (both sides) and the output-reduction-gear packages (both sides). The output-reduction-gear packages contain the brakes, and together with the sprocket hubs, make up the output reduction units. The outer flange of each output-reduction-gear output shaft assembly carries 10 studs for attaching the sprocket hub. The transmission provides a fluid torque converter connection between engine and final drive and three selective gear ratios forward and one ratio in reverse. Repair information is contained in TM 9-2520-215-34, Direct and General Support Maintenance for Transmission, Cross-Drive Assembly (Allison Model XT-1410-4).

i. Tracks and Suspension. The track laying system includes 12 dual road wheels (six on each side) that ride on the two 84-link tracks. Two double sprocket hubs power the tracks. Two compensating idler dual wheels and six track support dual rollers (three on each side) make up the balance of the track laying portion of the track and suspension system. The road wheels are mounted on suspension arms which bear the weight of the vehicle. Torsion bars, anchored to the hull at one end and to each suspension arm at the other, provide spring action for the suspension arms. An adjustable link, between each compensating idler wheel arm and front road wheel arm, provides for adjustment of track tension. Shock absorbers at the first, second and sixth road wheels limit the rate of suspension arm movement at those points. Double volute bumper springs at the first and sixth road wheel arms provide cushioning during maximum road wheel arm travel. Refer to TM 9-2350-256-10, Operator's Manual, and TM 9-2350-256-20, Organizational Maintenance Manual, for replacement and repair instructions.

j. Hull and Cab. The hull and cab are constructed of cast armor and armor plate welded into a single unit. Armor is distributed to protect the crew and equipment against small-arms fire, medium artillery shell fragments and 20-pound antitank mines. Hull bottom armor is equivalent to that of current medium tanks. The hull is equipped with an armored, turret-type cupola that provides a mount for the caliber 0.50 machinegun. Additional armament stowed in the cab consists of two M16 or M14 rifles, two submachineguns and 10 LAW rockets. Four form-fitting, padded, adjustable seats are provided for the four-person crew. Two removable pedestal stools accomodate two passengers. The two-shot fixed fire extinguisher system may be operated from inside or outside the vehicle. Two portable fire extinguishers are mounted in the crew compartment. Stowage racks for tools and other equipment are located at various points inside the cab. Stowage facilities for track sections, cables, tow bars and various recovery tools and equipment are provided on the outside of the hull and cab. A crew access door is located on each side of the cab. Two escape hatches in the front roof area of the cab are provided for the driver and mechanic. One escape hatch at the rear roof area of the cab is provided for the rigger. The commander's escape hatch is located in the cupola. Six M17 periscopes provide forward and partial side indirect vision for the driver and mechanic during daylight or night driving. One M17 periscope provides indirect rearward vision for the rigger. Four direct vision blocks, two at front and two at rear of cab, provide vision for driver, mechanic and rigger. Six direct vision blocks in the cupola base afford 360-degree vision for the commander. An AN/WS-2(V)1A passive night viewer may be installed in the driver's hatch when blackout operations are required.

k. Winch, Power Takeoff, Hoist and Spade. A hydraulically operated broom, hoist winch, main winch and spade comprise the basic recovery equipment of the vehicle. They are powered by the main hydraulic pump which is operated by a mechanical transmission driven by a power takeoff from the

main engine. An auxiliary hydraulic pump supplieshydraulic power for emergency and/or supplementaryuse in operation of the recovery equipment. Refer toRM 9-2350-256-10, Operator's Manual, TM9-2350-256-20, Organizational Maintenance Manual,and TM 9-2350-256-34-2, Direct and General SupportMaintenance Manual: Winch, Power Takeoff andHoist System, for additional description, operation, maintenance and repair information.

l. Deleted.

m. Miscellaneous Accessories. Items of equipment installed by the manufacturer, depot or creware listed in the Components and Support Item List(CASIL). See TM 9-2350-256-10, Operator's Manual,for list and instructions for use.

1-4. Tabulated Data

a. General

Armament	one caliber 0.50 Browning machinegun, M2, heavy barrel, flex; one machinegun mount A555ec38 or A88; two caliber 7.62 mm, M14 or 5.56 mm, M16, two caliber 0.45 submachineguns, M3A1 with equipment; 10 LAW rockets
Crew	4
Engine	diesel, V12, 4-cycle, air cooled model AVDS-1790-2DR
Transmission	combination transmission, differential, steer and brake system; model XT-1410-4; gears - 3 forward and 1 reverse
Weight:	
Gross (vehicle fully loaded with crew, passengers and payload)	112,000 lb
Net (vehicle with no crew or payload)	105,000 lb
Cargo (crew and maximum payload)	7,000 lb

b. Vehicle

Dimensions:	
Length	315-1/2 in.
Width	135 in.
Height	123 in.
Ground clearance	17 in.
Ground pressure	10.9 psi
Electrical system:	
Battery power	24 volt
Generator power	28 ± 0.7 vdc
Batteries	six 12 volt
Capacities (refill approximate):	
Fuel tanks	400 gal
Forward tank	252 gal
Right rear tank	74 gal
Left rear tank	74 gal
Main engine crankcase (refill)	16.5 gal
Transmission	17 gal
Main winch	11 gal
Hoist winch	3 gal
Auxiliary power unit	3-1/2 qt
Hydraulic system	95 gal
Mechanical transmission	1 gal
Tracks and Suspension:	
Shoes on each track section	84
Track support rollers (pairs)	6
Road wheel and arm assemblies (pairs)	12
Suspension	Torsion-bar type

c. Performance:

Vehicle speed (max.)	26 mph
Fuel consumption	0.7 mpg
Cruising range	300 miles
Allowable oil consumption, main engine (maximum)	0.2 gal per hour
Fording depth (max. without kit)	56 in.
Fording depth (max. with kit)	102 in.
Grade ascending ability (max.)	60 percent
Grade descending ability (max.)	60 percent
Vertical obstacle vehicle will climb (forward direction only)	42 in.
Maximum trench crossing width	103 in.
Turning circle (right or left)	pivot
Boom capacity	25 tons
Vehicle hoisting capacity:	
Spade	6 tons
Spade up (with lockout blocks - 4 part line)	20 tons
Spade down - 4 part line	25 tons
Boom lift height:	
8 ft. reach	19 ft
4 ft. reach	25 ft
Hoist winch:	
Cable size	5/8 in. dia, 200 ft long
Line pull and speed - 4 part line:	
Bare drum	50,000 lb at 9 fpm
Full drum	30,000 lb at 13 fpm
Main winch:	
Cable size	1-1/4 in. dia, 200 ft long
Line pull and speed:	
Bare drum	90,000 lb at 20 fpm
Full drum	51,400 lb at 42 fpm
Draw bar pull	90,000 lb
Hydraulic wrench	TM 9-5130-338-15P

d. Periscope.

Periscope M17 (7 included):	
Magnification	1X
Periscope offset	short
Field of view	50 degree vertical, 150 degree horizontal

e. Passive Night Viewer, AN/WS-2(V)1A (1 included):

Field of view:	
Width	800 mils (45°)
Height	680 mils (38°)
Depth of field	15 ft. to infinity
Focus	fixed

f. Auxiliary Equipment

Fire extinguisher:	
Portable (2 included):	
Type	carbon dioxide
Capacity:	
Volume	218 cu in.
Weight	5 lb
Weigh (fully charged)	15.5 lb
Fixed (2 banks):	
Type	carbon dioxide
Capacity:	
Volume	505 cu in.
Weight	10 lb
Weight (fully charged)	45 lb
Communication equipment:	
Radio set and interphone, consisting of: AN/VRC-44, AN/VRC-46, or AN/VRC-64 with	

suppressor MX-7778A and interphone AN/VRC-1(V)(4 controls)

Auxiliary Power Unit:
- Part number 11671436
- System battery voltage ..... 24 vdc
- System operating voltage ..... 28 vdc ±0.7 with fully charged batteries (i.e. charging current less than 50 amps)
- Cooling air at 2000 rpm (in vehicle) ..... 416 cu ft./min.
- Height ..... 35 in.
- Width ..... 18.75 in.
- Length ..... 29.75 in.
- Weight ..... 516.5 lb

Auxiliary Engine:
- Manufacturer ..... ONAN
- Model ..... DJBMA
- Part number 11671394
- Type ..... 2 cylinder, 4 cycle, diesel
- Cooling system ..... air cooled by direct drive centrifugal blower
- Bore ..... 3.250 in. diameter
- Stroke ..... 3.625 in.
- Compression ratio 19:1
- Horsepower (500 ft elevation at 115°F ..... 10.8 at 2000 rpm
- Fuel, diesel VV-F-800
- Oil capacity, including 1/2 qt. for filter ..... 3-1/2 qt
- Dry weight ..... 310 lb (approximate)

Auxiliary Generator:
- Manufacturer ..... Teledyne Continental Motors
- Part number MS51004-1
- Type ..... 28 vdc, 300 ampere, engine accessory
- Rated speed ..... 2500/6500 rpm
- Overspeed ..... 8000 rpm
- Cooling system ..... direct driven blower
- Weight ..... 94 lb

Auxiliary Hydraulic Pump:
- Manufacturer ..... Warner-Motive Div. of Borg Warner Corp.
- Model P2-5AH2-1-L
- Part number 11671411
- Type ..... fixed displacement (0.58 cu in./rev)
- Rated pressure ..... 2000 psi
- Inlet oil temperature ..... 145°F/155°F
- Inlet pressure ..... 5 in. Hg vacuum
- Delivery at 2000 engine rpm (3000 pump rpm) ..... 6.9 gpm min.
- Weight ..... 4.33 lb

CHAPTER 2

DIRECT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS AND EQUIPMENT

2-1. General

Tools, equipment and maintenance parts over and above those available to the using organization level are supplied to direct and general support maintenance units for maintaining and repairing the vehicle.

2-2. Parts

Maintenance parts are listed in TM 9-2350-256-34P-1, TM 9-2350-256-34P-2, TM 9-2520-215-34P (transmission) and TM 9-2815-220-34P (main engine), which are the authorities for requisitioning replacements. The supply, maintenance and recoverability code (SMR) indicated for each item determines if a component is to be replaced and/or repaired and the level responsible for replacement and/or repair. It is important that careful troubleshooting be used to determine, whenever possible, what parts are to be replaced before the component is torn down for repair.

2-3. Common Tools and Equipment

Standard and commonly used tools and equipment having general application are authorized for issue by TA and TOE.

2-4. Special Tools and Equipment

The special tools and equipment, listed in table 2-1 and illustrated in figure 2-1, are the only special tools and equipment necessary to perform the maintenance operations described in this technical manual. Refer to TM 9-2350-256-34P-1 and TM 9-2350-256-34P-2 for special tools and equipment allocations and requisitioning authority.

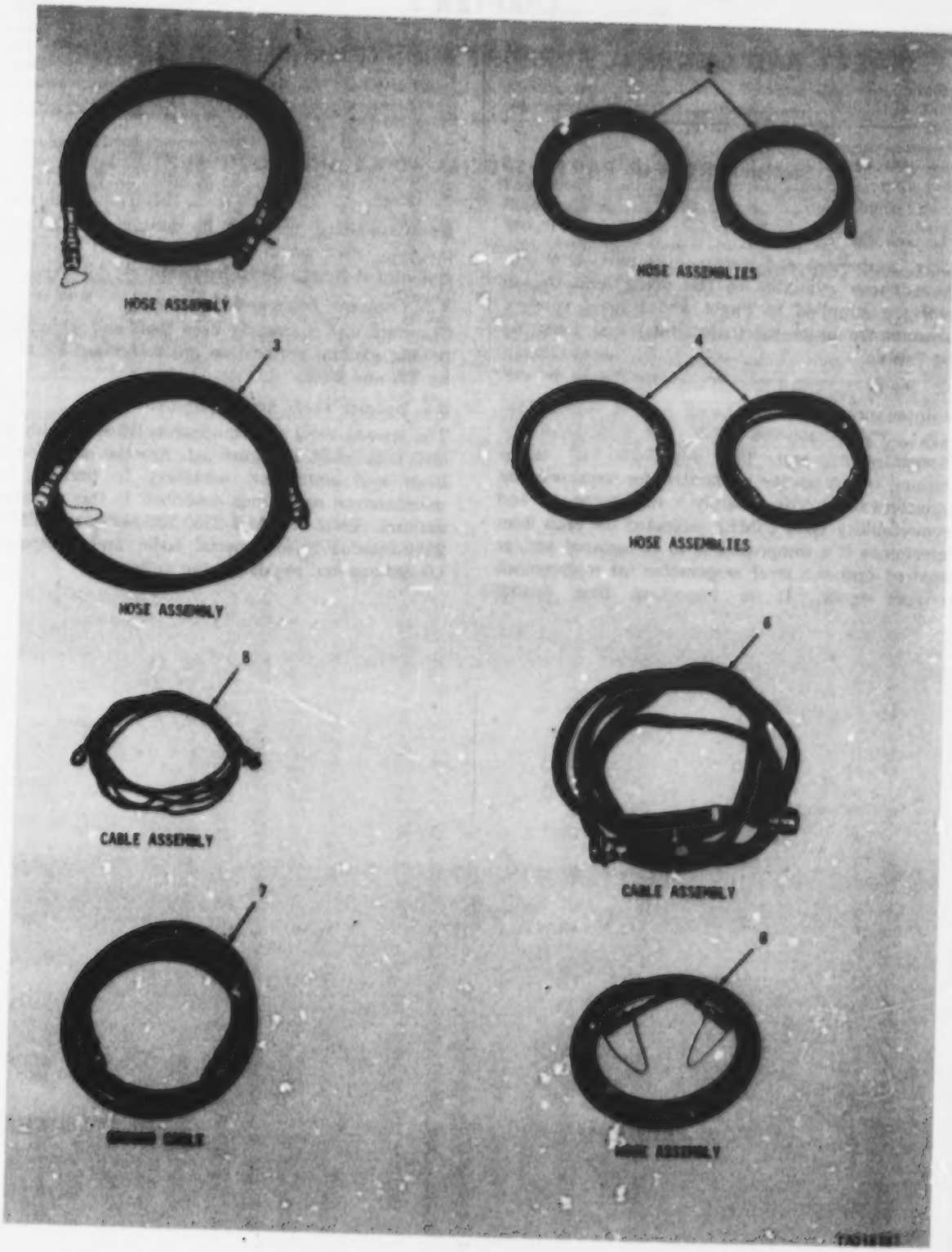


Figure 2-1. Special tools and equipment (Sheet 1 of 3).

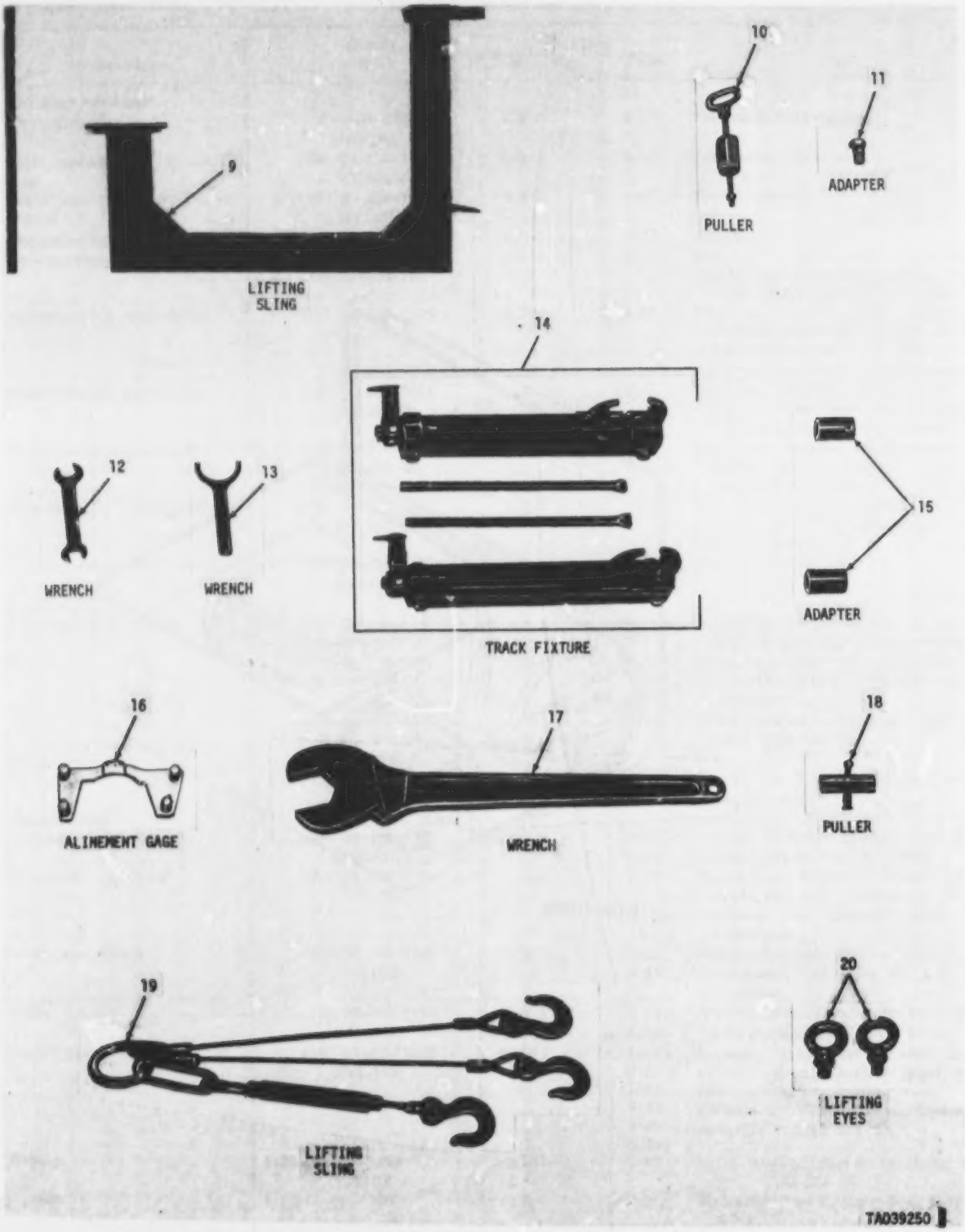


Figure 2-1. Special tools and equipment (Sheet 2 of 3).

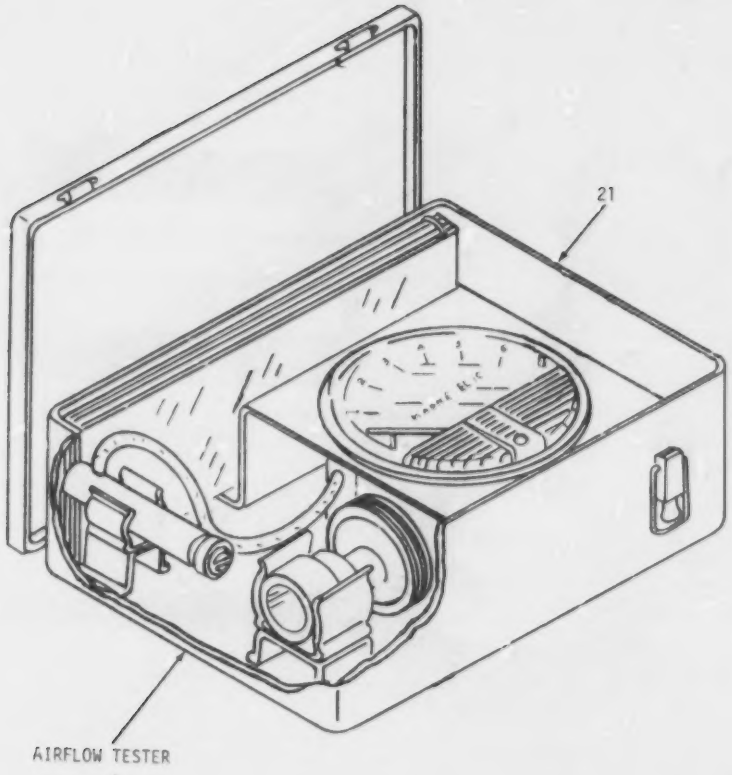


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Figure 2-1. Special tools and equipment (Sheet 3 of 3).

Table 2-1. Special Tools List

Nomenclature	National stock No.	Reference Item, Fig.	Reference Para	Use
Auxiliary power unit				
Cable, ground	2590-00-6223 (8708290)	7, 2-1	4-2*f*	Test run outside vehicle.
Cable assembly, power electrical	2590-00-614-7544 (11671581-3)	6, 2-1	4-2*f*	Test run outside vehicle.
Cable assembly, power electrical	2590-00-614-7545 (11671581-4)	5, 2-1	4-2*f*	Test run outside
Gage, alinement	(11671961)	16, 2-1	4-2*b*	Aline drive sprocket.
Hose assembly, nonmetallic	4720-00-617-6929 (11671580-1)	2, 2-1	4-2*f*	Test run outside vehicle; fuel tank to fuel pump line and fuel filter to injection pump line (2 per operation).
Hose assembly, nonmetallic	4720-00-619-9706 (11671580-2)	4, 2-1	4-2*f*	Test run outside vehicle; engine to fuel tank return line 11671065-15 and fuel pump hose 11671065-22 to primary fuel filter (2 per operation).
Hose assembly, nonmetallic	4720-00-619-9691 (11671580-3)	1, 2-1	4-2*f*	Test run outside vehicle; hydraulic pump section line from bulkhead coupling to suction line 11671065-21
Hose assembly, nonmetallic	4720-00-619-9689 (11671580-4)	8, 2-1	4-2*f*	Test run outside vehicle; pressure switch line hydraulic pump to pressure line 11671065-16
Hose assembly, nonmetallic	4720-00-619-9681 (11671580-5)	3, 2-1	4-2*f*	Test run outside vehicle; hydraulic pump line to discharge line 11671065-19
Puller, mechanical; flywheel and sprocket	5120-00-613-6775 (11671732)	18, 2-1	4-2*b*	Remove drive sprocket.
Suspension				
Adapter, socket wrench	5120-00-632-5797 (7026898)	15,2-1	2-12	Attaching power wrench to fisture 5120-00-605-3962 (2 per operation).
Fixture	5120-00-605-3926 (8741739)	14, 2-1	2-12	Track connecting; used with 5120-00-632-5797 Adapter, Socket Wrench (2 per operation).
Wrench	5120-00-277-6470 (GGG-W-631)	17, 2-1	2-12	Track tension adjusting; refer to TM 9-2350-256-10.
Gas-particulate filter unit				
Airflow tester	6680-00-436-4212 (ES-77-2120)	21, 2-1	3-80	Testing air flow of the gas-particulate filter unit
Miscellaneous				
Adapter	5120-00-767-9102 (10867497)	11, 2-1	2-24 2-29	Remove hydraulic cylinder pins used with puller 5120-00-310-4668.
Sling assembly, lifting	4910-01-046-8944 (11672258)	9, 2-1	2-30	Removal of hydraulic control panel (subplate) and mechanical transmission and hydraulic pump and suspension.
Lifting eye, vehicle	4910-00-766-1963 (10884605)	20, 2-1	2-30 2-35	Remove hydraulic control panel (1 per operation), and hoist winch (2 per operation).
Puller	5120-00-310-4669 (8708712)	10, 2-1	2-24 2-29	Remove hydraulic cylinder pins; used with adapter 5120-00-767-9102.
Sling, lifting	4910-00-473-7556 (7081593)	19, 2-1	2-15 2-18 2-19 2-24 2-30 2-35	Remove rear fuel tanks, hoist winch, hydraulic control panel (subplate), auxiliary power unit and mechanical transmission and hydraulic pump (TM 9-2350-256-20).
Wrench	5120-00-777-9099 (10884603)	13, 2-1	2-22	Level winder cylinder adjusting nut (TM 9-2350-256-20).
Wrench	5120-00-555-0060 (8395504)	12, 2-1,	2-30	Hydraulic line fittings (TM 9-2350-256-20).

Section II. TROUBLESHOOTING

NOTE

Information in this section is for use by direct support and general support (DS/GS) maintenance personnel in conjunction with and as a supplement to the troubleshooting section in the organizational maintenance manual. It provides continuation of instructions where a remedy in the organizational manual refers to DS/GS maintenance personnel for corrective action.

2-5. Scope

a. This section contains troubleshooting or malfunction information and tests for locating and correcting most of the troubles which may develop in the Recovery Vehicle, M88A1. Each malfunction or trouble symptom for an individual component, unit or system is followed by a list of tests or inspections necessary for you to determine probable causes and suggested corrective actions for you to remedy the malfunction.

b. This manual cannot list all possible malfunctions that may occur or all tests or inspections, and corrective actions. If a malfunction is not listed (except when malfunction and cause are obvious) or is not corrected by listed corrective actions, you should notify higher level maintenance.

c. Table 2-2 lists the common malfunctions that you may find during the operation or maintenance of the M88A1 or its components. You should perform the tests/inspections and corrective actions in the order listed.

NOTE

Before you use this table, be sure you have performed all normal operational checks. If you have a malfunction which is not listed in this table, notify the next higher level of maintenance.

NOTE

Refer to TM 9-2350-256-34-2 for troubleshooting main and auxiliary hydraulic systems.

Table 2-2. Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
FUEL TANKS
1. FUEL LEAKING FROM FORWARD FUEL TANKS
Inspect forward fuel tank for cracks or open seams. Fuel leaking thru a small crack can usually be detected by dust clinging to the wet area.
a. If leaking area is accessible without remvoing the fuel tank:
(1) Drain the fuel system (TM 9-2350-256-20, Medium Recovery Vehicle, M88A1).
(2) Close fuel valves to left and right rear fuel tanks.
(3) Remove the armor cover under the hull to expose the forward fuel tank drain plug. Remove the drain plug.
(4) Remove electric intank fuel pump (TM 9-2350-256-20, Medium Recovery Vehicle, M88A1).
(5) Slush tank interior with methylene chloride (pure) or chemical cleaner as specified in TB 750-1047, Elimination of Combustibles From Interiors of Metal or Plastic Gasoline and Diesel Fuel Tanks, to remove residual fuel, dirt, sediment and other foreign matter. Drain and air dry tank.
(6) Weld cracked area as required.
(7) Close forward fuel tank bypass valve and drain valve. Install drain plug in bottom of tank.
(8) Install electric fuel pump (TM 9-2350-256-20, Medium Recovery Vehicle, M88A1).
(9) Disconnect the fuel vent hose on top of the forward fuel tank.
(10) Connect an air hose and suitable gage to the disconnected vent opening in the forward fuel tank, apply 3-4 psi internal air pressure.
(11) Apply soapy water solution, consisting of liquid soap diluted with 20-40% water, to all exterior surfaces of tank and inspect for air bubble formation.
(12) Mark location of any bubble formation, release air pressure, rinse and dry tank and weld the marked area.
(13) Repeat points (10), (11), and (12) if required.
b. If leaking area is inaccessible with the fuel tank installed:
(1) Drain the fuel system (TM 9-2350-256-20, Medium Recovery Vehicle, M88A1).
(2) Remove the forward fuel tank from the vehicle (TM 9-2350-256-20, Medium Recovery Vehicle, M88A1).
(3) Slush tank interior with methylene chloride (pure) or chemical cleaner as specified in TB 750-1047, Elimination of Combustibles From Interiors of Metal or Plastic Gasoline and Diesel Fuel Tanks, to remove residuel fuel, dirt, sediment and other foreign matter. Drain and air dry tank.

Table 2-2. Troubleshooting—Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

FUEL TANKS—Continued

(4) Inspect tank for any obvious cracks or open seams. Inspect mounting brackets, mounts and cushions for cracks or breaks. Weld assembly and components as required.
(5) Close all openings with temporary plugs or other closures and apply 3-4 psi internal air pressure.
(6) Apply soapy water solution, consisting of liquid soap diluted with 20-40% water, to all exterior surfaces of tank and inspect for air bubble formation.
(7) Mark location of any bubble formation, rinse and dry tank and weld the marked areas.
(8) Repeat points (5), (6), and (7) if required.
(9) The electric intank fuel pump and other fittings and accessories may be assembled on the tanks either before or after installation of the tanks in the vehicle. Refer to TM 9-2350-256-20, Medium Recovery Vehicle, M88A1 for installation instructions.

2. FUEL LEAKING FROM RIGHT AND/OR LEFT REAR FUEL TANK

Step 1. Remove the engine deck (TM 9-2350-256-20, Medium Recovery Vehicle, M88A1). Inspect fuel tank for cracks or open seams. Fuel leaking from a small crack can usually be detached by dust clinging to the wet area.

Step 2. If fuel leak cannot be detected or repaired with powerplant installed in vehicle, remove the fuel tank. (For removal of left rear fuel tank, refer to para. 2-18). (For removal of right rear fuel tank, refer to para. 2-19).

Step 3. If fuel leak cannot be detected or repaired with fuel tank installed in vehicle, remove the fuel tank. (For removal of left rear fuel tank, refer to para. 2-18). (For removal of right rear fuel tank, refer to para. 2-19).

a. Drain the fuel system (TM 9-2350-256-20, Medium Recovery Vehicle, M88A1).
b. Slush tank interior with methylene chloride (pure) or chemical cleaners as specified in TB 750-1017, Elimination of Combustibles From Interiors of Metal or Plastic Gasoline and Diesel Fuel Tanks, to remove residual fuel, dirt, sediment, and other foreign matter. Drain and dry fuel tank.
c. Inspect tank for any obvious cracks or open seams. Inspect mounting brackets, mounts, and cushions for cracks and breaks. Weld assembly and components as required.
d. Close all openings with temporary plugs or other closures and apply 3-4 psi internal air pressure.
e. Apply soapy water solution, consisting of liquid soap diluted with 20-40% water, to all exterior surfaces of tank and inspect for air bubble formation.
f. Mark location of any bubble formation, rinse and dry tank and weld the marked areas.
g. Repeat d, e, and f, if required.

PURGE PUMP

3. MAIN ENGINE MANIFOLD HEATERS DO NOT WORK

Check manifold heater switch and associated wiring. Refer to Fault Isolation Diagram, fig. 2-23, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.

Repair or replace defective components or parts (para 3-27 and 3-28).

4. PURGE PUMP DIFFICULT TO PUMP OR DOES NOT PUMP

Disassemble purge pump (para 3-26). Clean all parts in mineral spirits paint thinner or drycleaning solvent. Inspect all components for cracks, distortion, and/or evidence of excessive wear.

Replace all defective components.

ELECTRICAL SYSTEM

5. BATTERY-GENERATOR INDICATOR READS IN YELLOW OR LOWER RED REGION WITH MAIN ENGINE RUNNING AND MAIN GENERATOR IN SYSTEM (GENERATOR CUTOUT SWITCH CLOSED)

Step 1. Check for defective switching relay box. Refer to Fault Isolation Diagram, fig. 2-35, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.

Repair or replace switching relay box (para 3-47).

Step 2. Check for defective main generator armature relay. Refer to Fault Isolation Diagram, fig. 2-35, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.

Repair or replace main generator armature relay (para 3-46).

6. BATTERY-GENERATOR INDICATOR READS IN YELLOW OR LOWER RED REGION WITH APU ENGINE RUNNING AND APU GENERATOR SWITCH ON. (MAIN ENGINE NOT RUNNING).

Step 1. Deleted

Step 2. Deleted

Step 3. Check for defective APU generator switch. Refer to Fault Isolation Diagram, fig. 2-39, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.

Replace switch, if defective (para 3-45).

Step 4. Check for defective hydraulic pressure switch. Refer to Fault Isolation Diagram, fig. 2-38, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.

Adjust or replace pressure switch (para 3-63).

Step 5. Check for damaged or defective APU generator (para 4-2d). Refer to Fault Isolation Diagram, fig. 2-35, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.

Replace defective generator (para 4-2b).

Table 2-2. Troubleshooting—Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

ELECTRICAL SYSTEM—Continued

7. BATTERY GENERATOR INDICATOR READS IN BOTTOM OF LOWER RED REGION (NO DEFLECTION) WITH MASTER SWITCH ON
   Check for defective master relay. Refer to Fault Isolation Diagram, fig. 2-37, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.
   Repair or replace master relay (para. 3-46).
8. ALL CIRCUITS DEAD EXCEPT PERSONNEL HEATER, MASTER RELAY LAMP, AND SLAVE RECEPTACLE
   Check main power bus. Refer to Fault Isolation Diagram, fig. 2-21, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.
   Repair or replace defective components.
9. BILGE PUMP DOES NOT OPERATE
   Check bilge pump circuit breaker, relay, and associated wiring harnesses. Refer to Fault Isolation Diagram, fig. 2-55, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.
   Repair or replace defective components.
10. INFRARED SYSTEM (DRIVER'S PERISCOPE) FAILS TO OPERATE
    Check for defective high voltage power pack. Refer to Fault Isolation Diagram, fig. 2-61, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.
    Replace infrared power pack, if defective (para. 2-21).

MECHANICAL TACHOMETER AND SPEEDOMETER

11. MECHANICAL TACHOMETER OR SPEEDOMETER FAILS TO REGISTER
    Step 1. Check for flexible shaft ends that might have twisted off.
    Replace flexible shaft assembly, if defective (para 2-20).
    Step 2. Check 90° drive adapter for stripped threads.
    Repair or replace adapter (para 3-40).

AUXILIARY POWER UNIT

12. ENGINE FAILS TO CRANK
    Step 1. Check for defective starting system components and/or associated wiring. Refer to Fault Isolation Diagram, fig. 2-41, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.
    Step 2. Repair or replace defective starting system components and/or associated wiring (para 2.-15a, 2-21b, 2-21c, 3-48, and 4-2b of TM 9-2350-256-34-1 and para. 2-58 of TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
    Step 3. Attempt to turn engine over using a 5/8 inch, 1/2 inch square drive socket, extension and torque wrench set for 70 lb-ft, on the flywheel mounting screw, located at the center of the flywheel. If engine turns over, recheck electrical system using Fault Isolation Diagram, fig. 2-41, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1. If engine fails to turn over, drain oil from APU crankcase. Remove chaincase and drive sprocket (para 4-2).
    a. If engine will not turn over with 70 lb-ft of torque applied to flywheel mounting screw, repair or replace APU engine (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
    b. If engine will turn over with 70 lb-ft or less of torque applied to flywheel mounting screw, inspect generator and hydraulic pump for seizure. Replace defective components.
13. ENGINE CRANKS BUT FAILS TO START
    Step 1. Check fuel shutoff switch, fuel solenoid, and associated wiring. Refer to Fault Isolation Diagram, fig. 2-43, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.
    Repair or replace defective components (para. 3-45 and TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
    Step 2. Open the bleeder valve on the primary fuel filter and allow all the diesel fuel to drain from the filter. Have an assistant attempt to start the APU. If fuel is pumped from the filter, close the valve.
    If no fuel is pumped from the filter, replace the fuel pump (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
    Step 3. Remove the APU armor cover (TM 9-2350-256-20, Medium Recovery Vehicle, M88A1). Loosen, but do not remove, one of the two high pressure fuel tubes from the fuel injection pump. Have an assistant attempt to start the APU.
    a. If no fuel is pumped from the loosened fuel tube, replace the fuel injector pump (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
    b. If fuel is pumped from the loosened fuel tube, check the fuel injector nozzles (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
14. ENGINE HARD TO START
    Step 1. Remove APU armor cover (TM 9-2350-256-20, Medium Recovery Vehicle, M88A1).
    Step 2. Test fuel injector pump (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
    Replace fuel injector pump if defective (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
    Step 3. Test fuel injector nozzles (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
    Replace fuel injector nozzles if defective (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
    Step 4. Check engine timing (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
    Retime engine (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
    Step 5. Check valve clearance (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
    Adjust valve clearance (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).

Table 2-2. Troubleshooting—Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
AUXILIARY POWER UNIT—Continued
Step 6. Check engine compression (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA). Replace engine (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
15. ENGINE HARD TO START IN COLD WEATHER
Step 1. Check for defective preheat components and/or associated wiring. Refer to Fault Isolation Diagram, fig. 2-41, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1. Repair or replace defective preheat components and/or associated wiring (para. 2-17, 2-58, and 3-8 of TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
16. ENGINE STARTS BUT FAILS TO KEEP RUNNING
Step 1. Remove APU armor cover (TM 9-2350-256-20, Medium Recovery Vehicle, M88A1).
Step 2. Check fuel pump pressure (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA). Replace fuel pump (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 3. Test fuel injector pump (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA). Replace fuel injector pump (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 4. Test fuel injector nozzles (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA). Replace fuel injector nozzles (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 5. Check valve clearance (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model (DJBMA). Adjust valves (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
17. ENGINE OVERHEATS
Step 1. Remove APU from vehicle (para 2-15A). Remove and clean oil cooler (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
18. ENGINE MISFIRES, LACKS POWER OR EMITS BLACK SMOKE
Step 1. Check engine for proper rpm setting (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA). Adjust rpm setting if required (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 2. Remove APU armor cover and side panel (TM 9-2350-256-20, Medium Recovery Vehicle, M88A1).
Step 3. Check glow plugs and lead wires using Fault Isolation Diagram, fig. 2-41, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1. Repair or replace defective parts (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 4. Test fuel injector pump (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA). Replace fuel injector pump if defective (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 5. Test fuel injector nozzles if defective (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA). Replace fuel injector nozzles if defective (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 6. Check engine timing (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA). Retime engine if required (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 7. Check valve clearance (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA). Adjust valve clearance (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 8. Check engine compression (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA). Replace engine (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
19. ENGINE KNOCKS
Step 1. Remove APU armor cover (TM 9-2350-256-20, Medium Recovery Vehicle, M88A1).
Step 2. Check engine timing (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA). Retime engine (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 3. Check valve clearance (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA). Adjust valve clearance (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 4. Test fuel injector pump (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA). Replace fuel injector pump if defective (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 5. Test fuel injector nozzles (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA). Replace fuel injector nozzles (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 6. If cause of engine knocks cannot be corrected by above steps, replace engine (para 4-2b).
20. ENGINE USES EXCESSIVE OIL AND EMITS LIGHT BLUE SMOKEY EXHAUST
Step 1. Check air intake system for restrictions. Remove all restrictions.
Step 2. Operate APU with hydraulic system selector control lever in AUX position for fifteen minutes. If light blue smokey exhaust continues, replace engine (para 4-2b).
21. HIGH AIR TEMPERATURE LIGHT ON APU CONTROL BOX FAILS TO OPERATE PROPERLY
Check for defects in electrical circuit. Refer to Fault Isolation Diagram, fig. 2-47, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1. Repair or replace defective components.
22. LOW OIL PRESSURE LIGHT IN APU CONTROL BOX FAILS TO OPERATE PROPERLY
Check for defects in electrical circuit. Refer to Fault Isolation Diagram, fig. 2-45, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1. Repair or replace defective components.

Table 2-2. Troubleshooting—Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

AUXILIARY POWER UNIT—Continued

23. OIL PRESSURE GAGE GAILS TO OPERATE
Check for defect in electrical circuit. Refer to Fault Isolation Diagram, fig. 2-49, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.
Repair or replace defective components.

24. BATTERY-GENERATOR INDICATOR READS IN YELLOW OR LOWER RED REGION WITH APU ENGINE RUNNING AND APU GENERATOR SWITCH ON
Step 1. Deleted.
Step 2. Deleted
Step 3. Check for defective APU generator switch. Refer to Fault Isolation Diagram, fig. 2-39, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.
Replace switch, if defective (para 3-45).
Step 4. Check for defective hydraulic pressure switch. Refer to Fault Isolation Diagram, fig. 2-38, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.
Adjust or replace pressure switch (para. 3-63).
Step 5. Check for damaged or defective APU generator (para 4-2d). Refer to Fault Isolation Diagram, fig. 2-35, TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.
Replace defective generator (para 4-2b).

25. BATTERY-GENERATOR INDICATOR READS IN YELLOW OR LOWER RED REGION WITH APU ENGINE RUNNING AND APU GENERATOR SWITCH ON WITH NO AUXILIARY HYDRAULIC PRESSURE
Step 1. Remove APU from vehicle (para 4-2b). Remove rear chain housing cover from APU, (para 4-2b). Inspect drive chain and gears.
Replace if defective (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).

26. ENGINE DOES NOT OPERATE AT 2000 ± 100 RPM UNDER LOAD CONDITIONS
Step 1. Check fuel system for air.
Bleed air from fuel system.
Step 2. Operate APU with hydraulic system selector control lever in AUX position for fifteen minutes.
Step 3. Check governor linkage (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Repair, replace, or adjust governor linkage as required (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 4. Check engine timing (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Retime engine (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 5. Test fuel injector pump (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Replace fuel injector pump if defective (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 6. Test fuel injector nozzles (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Replace fuel injector nozzles if defective (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 7. Check valve clearance (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Adjust valve clearance (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Step 8. Check engine compression (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).
Replace engine (TM 9-2815-221-34&P, Engine, Diesel, Industrial Type, Model DJBMA).

BILGE PUMP

27. BILGE PUMP DOES NOT OPERATE
Step 1. Check brushes for excessive wear. Brush should be in contact with rotor assembly. Brush should not be worn down to the lead.
Replace worn brushes (para 4-5).
Step 2. Deleted.
Step 3. Check for defective circuit breaker, relay, circuit breaker power lead, or relay wiring harness. Refer to Fault Isolation Diagram, fig. 2-55. TM 9-2350-256-20, Medium Recovery Vehicle, M88A1.
Repair and/or replace defective components (paras 2-13 and 3-48).

28. BILGE PUMP OPERATES BUT DOES NOT PUMP SUFFICIENT WATER
Step 1. Check for clogged pump inlet screen.
Remove inlet screen and clean (para. 4-5).
Step 2. Check for defective propeller.
Replace propeller (para. 4-5).

Table 2-2. Troubleshooting—Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

BILGE PUMP—Continued

29. BILGE PUMP TOO NOISY
    Step 1. Check for loose or worn bearings.
    Replace defective bearings (para 4-5).
    Step 2. Check for chattering brushes and insufficient brush spring pressure.
    Replace brushes (para 4-5).

PERSONNEL HEATER

NOTE

Refer to TM 9-2350-256-20, Medium Recovery Vehicle, M88A1, for wiring diagrams of personnel heater and heater control box.

30. HEATER FAILS TO START—MOTOR DOES NOT RUN
    Step 1. Depress PRESS TO TEST lamp. If lamp fails to light, check power supply and circuit breaker.
    Repair or replace defective component.
    Step 2. Check power at terminals 2 and 3 on heater. No power indicates defective cable or connector between control box and heater.
    Repair or replace defective cable or connector.
    Step 3. Remove blower (para 3-33*c*(1)) and test for defective resistor, diode assembly, or motor (para 3-36*b*(3)(1)).
    Replace defective component.
31. HEATER FAILS TO START—MOTOR RUNS
    Step 1. Check the power at both NO terminals with control switch in START position. Power at only one terminal indicates a defective flame detector switch.
    Repair, adjust (para 3-35*b*(4)), or replace defective flame detector switch.
    Step 2. Check power at igniter terminal on ignition control with control switch in START position. Lack of power at igniter terminal indicates a defective ignition control.
    Replace defective ignition control (para 3-33*c*(7)).
    Step 3. Remove igniter (para 3-33*c*(3)) and inspect, with control switch in START position.
    Replace defective igniter (para 3-33*c*(3)).
    Step 4. Check power at terminal 30 on overheat switch with control switch in START position. Lack of power indicates defective overheat switch.
    Clean or replace overheat switch (para 3-33*c*(5)).
    Step 5. Check power at terminal A on control box connector with control switch in START position. Lack of power indicates defective control box, wiring, or control switch.
    Replace defective component.
    Step 6. Loosen fuel supply line at fuel control IN port and move control switch to START. Erratic fuel flow indicates need to bleed fuel control valve.
    Bleed fuel control valve. (para 3-33*c*(6)).
    Step 7. Loosen fitting at fuel control valve outlet elbow and move control switch to START. If no fuel flows from outlet, it indicates a defective fuel control valve.
    Replace fuel control valve (para 3-33*c*(6)).
    Step 8. Remove burner (para 3-33*c*(8)) and inspect for malfunction.
    Replace defective burner.
32. HEATER FAILS TO START—MOTOR RUNS; WHITE FUEL VAPOR AT EXHAUST
    Step 1. Remove igniter (para 3-33*c*(3)) and inspect, with control switch in START position.
    Replace defective igniter (para 3-33*c*(3)).
    Step 2. Inspect ignition wick (para 3-35*b*(3)(*c*)). If wick is wet it indicates that burner is flooded.
    Follow procedure outline in paragraph 3-35*b*(3)(*c*)*3* to start heater.
33. HEATER CYCLES ON OVERHEAT SWITCH
    Step 1. Check blower inlet and ducts for obstructions which restrict ventilating air flow.
    Clean and repair as necessary.
34. LOW HEAT OUTPUT
    Step 1. Check heat switch. If switch is on LO it will cause low heat output.
    Move switch to HI.
    Step 2. Check power to terminal 5 with heater running, control switch in RUN position, and heat switch in HI position. Lack of power at terminal 5 indicates defective heat switch or wiring.
    Repair wiring or replace heat switch.
    Step 3. Check for smoky exhaust. This condition can indicate a defective burner.
    Repair or replace burner (para 3-33*c*(8)).
    Step 4. Check fuel flow rate (para 3-36*b*(1)(*h*)). Incorrect flow rate and low heat output can be caused by dirty or defective fuel control valve.
    Repair or replace fuel control valve (para 3-33*c*(6)(*b*)).

Table 2-2. Troubleshooting—Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
PERSONNEL HEATER—Continued
35. SMOKY EXHAUST
Step 1. Check voltage of hot lead to control box. Low supply voltage is a possible cause of smoky exhaust. Correct the power supply problem that is causing the low voltage.
Step 2. Check the exhaust piping for obstructions. A restricted exhaust can cause this smoky condition. Clean or repair exhaust piping as necessary.
Step 3. Check combustion air inlet for dirt or damage. A restricted combustion air inlet will cause a smoky exhaust. Clean or repair as necessary.
Step 4. Check fuel rate (para 3-36*b*(1)(*h*). Incorrect fuel flow rate, which can cause smoky exhaust, is due to dirty or defective fuel control valve. Repair or replace fuel control valve (para 3-33*c*(6) (*b*)) if flow rate cannot be adjusted to fall within limits in paragraph 3-36*b*(1)(*h*).
Step 5. Check burner. A defective burner can cause a smoky exhaust. Repair or replace defective burner (para 3-33*c*(8)).
Step 6. Check blower motor and blower wheel. A defective blower motor or improperly adjusted blower wheel can cause a smoky exhaust. Remove blower (para 3-33*c*(1)) and test (para 3-35*b*(1)). Repair or replace defective blower. Adjust blower wheel if necessary.
Step 7. Check heat exchanger for soot or carbon restrictions. Clean or repair heat exchanger (para 3-34*e*).

Section III. GENERAL MAINTENANCE

2-6. Lubrication

Lubrication instructions for the M88A1 are contained in LO 9-2350-256-12.

2-7. Lockwire and Sealing Compound

Locking wire is to be installed by the double twist method. Apply sealing compound, NSN 8030-00-543-4384, to all pipe threads during installation.

2-8. Torque Values

Torque data for the specific hardware applications required in various vehicle installations is specified in the applicable sections of this manual.

2-9. Deck Covers, Grilles, Doors and Cab Subfloor Plates

Various deck covers, grilles, doors and cab subfloor plates must be removed prior to removal of many components. To locate deck covers, grilles, and doors, refer to figure 2-2. To locate cab subfloor plates, refer to figure 2-3. Refer to TM 9-2350-256-20 for removal and installation instructions.

2-9.1. Service Intervals—Personnel Heater

Refer to table 2-3 for recommended periodic service intervals for the personnel heater.

Table 2-3. Recommended Periodic Service Intervals

Hours of Operation	Service	Reference
Every 100 Hours	Check fuel supply	Paragraph 3-34*c*.
	Inspect wires for worn or broken insulation. Check that all connectors are tight.	
	Check air inlets for clogging. Remove debris and tighten loose duct connections.	
Every 200 hours (At ambients below 0°F.)	Inspect igniter.	Paragraph 3-35*b* (3).
Every 400 hours	Remove and clean flame detector switch.	Paragraph 3-35*b*(4).
	Remove and clean burner.	Paragraph 3-34*e*. Remove the burner as described in paragraph 3-33*c*(8) and clean it to remove deposits and carbon.
	Inspect igniter.	Paragraph 3-35*b*(3).
Every 800 to 1000 hours	Overhaul the heater.	Paragraphs 3-33 thru 3-36

Legend for fig. 2-2:

1 Auxiliary power unit access cover
2 Auxiliary power unit access door
3 Right front engine deck air inlet door
4 Right front intermediate engine deck air inlet door
5 Engine deck right door
6 Right intermediate engine deck air inlet grille
7 Right rear intermediate engine deck air inlet door
8 Right rear engine deck air inlet door
9 Right stayline hydraulic cylinder access cover
10 Cover, deep water fording exhaust—right
11 Engine deck right exhaust door
12 Engine exhaust deflector
13 Engine deck right center exhaust door
14 Engine deck left center exhaust door
15 Engine deck left exhaust door
16 Cover, deep water fording exhaust—left
17 Left stayline hydraulic cylinder access cover
18 Left rear engine deck air inlet door
19 Left rear intermediate engine deck air inlet door
20 Left intermediate engine deck air inlet grille
21 Left intermediate engine deck air inlet door
22 Left front intermediate engine deck air inlet door
23 Center left front engine deck air inlet grille
24 Left front engine deck air inlet door
25 Left front, front engine deck air inlet door
26 Fuel tank filler neck cover
27 Center left front intermediate engine deck air inlet grill
28 Center front engine deck air inlet grille
29 Center right front engine deck air inlet grille
30 Engine oil check access door
31 Engine oil filler tube access door
32 Engine deck transmission right front access door
33 Engine deck transmission right rear access door
34 Engine deck transmission center front access door
35 Engine deck transmission left rear access door
36 Engine deck transmission left front access door

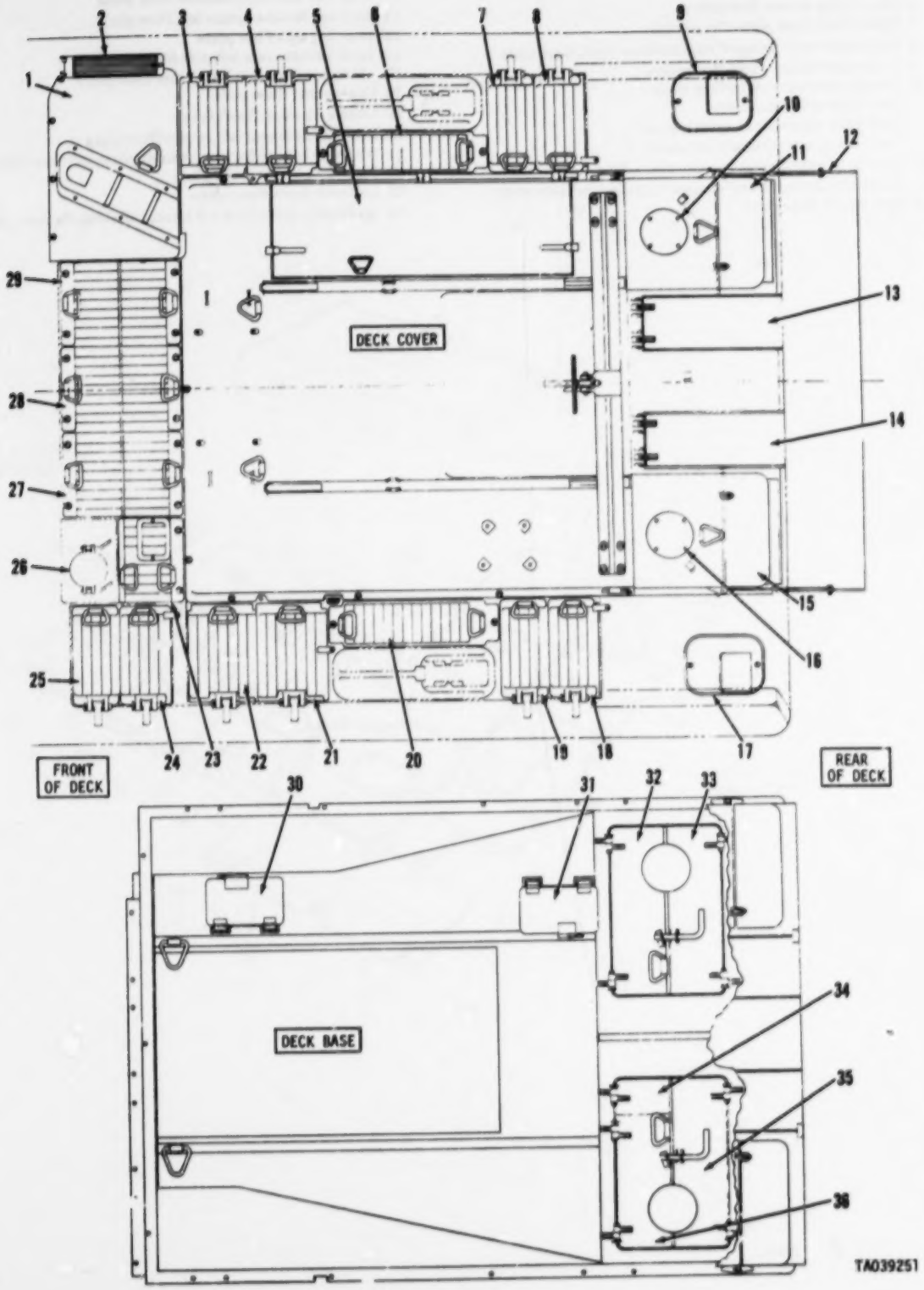


Figure 2-2. Deck covers, grilles and doors—schematic diagram.

Legend for fig. 2-3:

1 Right side front floor plate
2 Right front access floor plate
3 Right front floor plate rear access
4 Hydraulic valve forward intermediate right floor plate
5 U-35 winch center right floor plate
6 Intermediate rear right floor plate
7 Rear right side floor plate
8 Hydraulic connections access cover
9 Rear intermediate right floor plate
10 Rear intermediate right access floor plate
11 Hydraulic line intermediate rear right center floor plate
12 Rear center floor plate
13 Rear left side intermediate floor plate
14 Stowage basket center left floor plate
15 Rear left side floor plate
16 Intermediate rear left side floor plate
17 Intermediate rear left center floor plate
18 Center rear floor plate
19 Center forward floor plate
20 Intermediate rear left access floor plate
21 Stowage basket forward intermediate left floor plate
22 Floor and light mount plate
23 Left side front floor plate
24 Hydraulic valve forward intermediate right floor plate

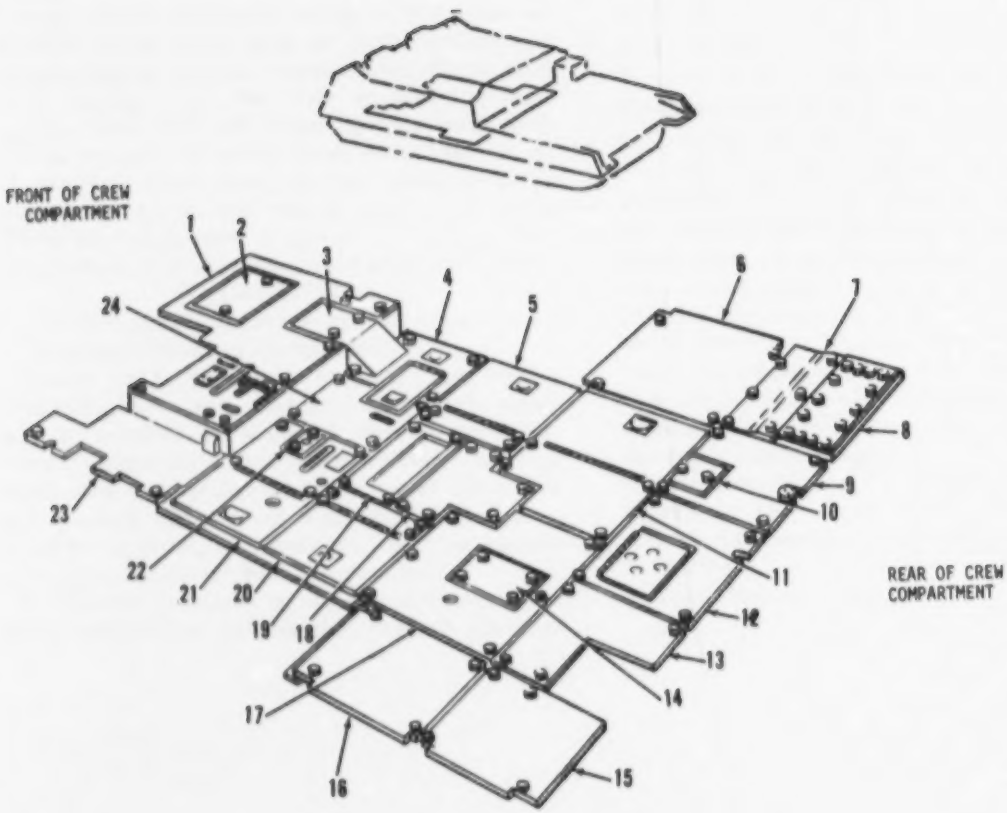


Figure 2-3. Cab subfloor plates—schematic diagram.

Section IV. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS AND AUXILIARIES

2-10. Preparation for Removal and Installation

a. The vehicle should be cleaned as thoroughly inside and out as is advisable for the time available and the operations to be performed. The affected component and the adjacent area should be cleaned in any case.

b. Remove any items of on-vehicle equipment, armament or vehicular components which may interfere with efficient operation. Where disconnection of lines will result in loss of fluid, close any shutoff valves which may be in the system and, where possible, have a container available to catch fluid issuing from the lines at the disconnect points. Open hull and engine compartment drain valves to drain off accumulated water, fuel or oil. If complete disassembly of the vehicle is to be performed, pump out and/or drain fuel tanks. While the component is out of the vehicle, clean the exposed hull or compartment areas thoroughly.

CAUTION

Do not operate hydraulic system when any hydraulic lines are disconnected.

c. See that all tools required are readily available. Make sure that any spare parts which may be required are available. Provide envelopes, covers, tarpaulins, line plugs or other material which may be required for protection of the vehicle and exposed components until repairs are made. Provide small parts containers, tags or electric wire and terminal markers, as required.

d. Provide hoisting or lifting equipment for heavy components and see that supports, benches or stands are made ready to receive the components when they are removed.

e. Sufficient personnel should be available for the operation and they should be thoroughly advised of their duties before work is started. Provide all personnel with any protective equipment which may be required, such as goggles, special clothing, gloves, etc. See that all unassigned personnel are clear of the immediate working area.

2-11. Fenders

Refer to TM 9-2350-256-20 for removal and installation instructions.

2-12. Suspension Systems

a. Refer to TM 9-2350-256-10 for removal and installation of tracks. Refer to TM 9-2350-256-20 for removal and installation of hub and sprocket assemblies, compensating idler assemblies, road wheels and hubs, torsion bars, road wheel arms, torsion bar anchors, road wheel arm housings, shock absorbers, bumper springs, track support roller assemblies and output reduction drives.

b. To facilitate the removal of the tracks, disassemble track fixture (table 2-1) and attach the fixture adapter (table 2-1). Use the hydraulic impact wrench with the fixture and adapter when separating the vehicle tracks. See figure 2-4 for fixture disassembly instructions. Refer to TM 9-2350-256-10 for operating instructions on the hydraulic impact wrench.

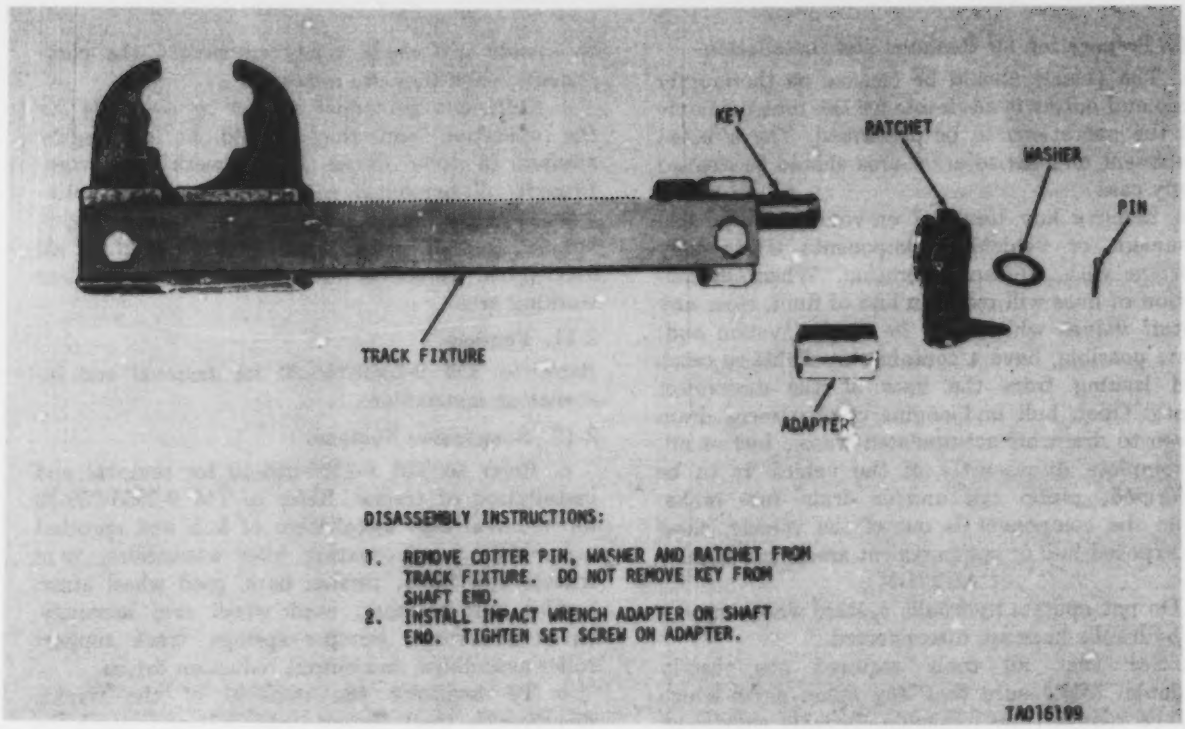

KEY
RATCHET
WASHER
PIN
TRACK FIXTURE
ADAPTER
DISASSEMBLY INSTRUCTIONS:
1. REMOVE COTTER PIN, WASHER AND RATCHET FROM TRACK FIXTURE. DO NOT REMOVE KEY FROM SHAFT END.
2. INSTALL IMPACT WRENCH ADAPTER ON SHAFT END. TIGHTEN SET SCREW ON ADAPTER.
TA016199

Figure 2-4. Disassembly of track fixture for use with hydraulic impact wrench adapter.

2-13. Seats

Refer to TM 9-2350-256-20 for removal, repair and installation of seats.

2-14. Personnel Heater

a. Removal. Remove the personnel heater fuel filter and air duct hose as shown in figure 2-5. Refer to TM 9-2350-256-20 for removal and installation of the personnel heater assembly, exhaust components, fuel pump and guard.

b. Installation. Install the personnel heater components and assemble in reverse order of removal.

2-15. Auxiliary Power Unit

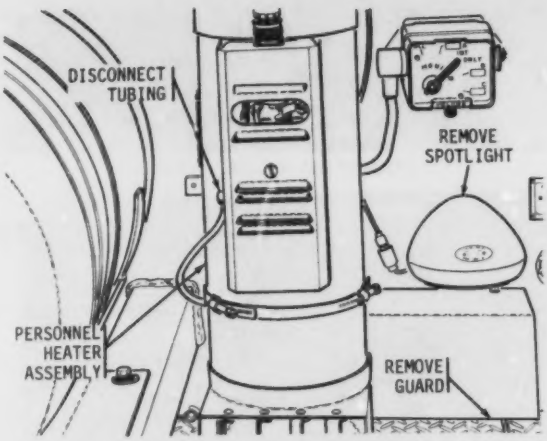
a. Removal. Remove the APU as shown in figure 2-6. Have a test fixture available to support the APU outside the vehicle (para. 4-2).

b. Service and Test. Whenever the APU is out of the vehicle, clean the fuel filter sediment bowl (View I, fig. 2-6). Prior to installing the unit in the vehicle, perform the testing and adjustment procedures described in paragraph 4-2(f).

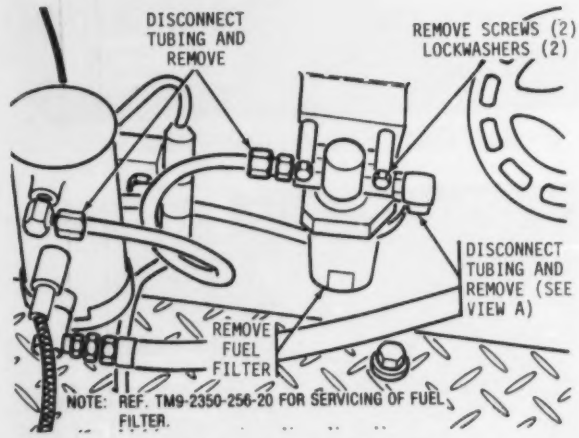
NOTE

Prior to installation, the starter/generator must meet a locked rotor torque test of 30 lb-ft. output torque for an input voltage of 15 volts applied to both fields and armature circuits.

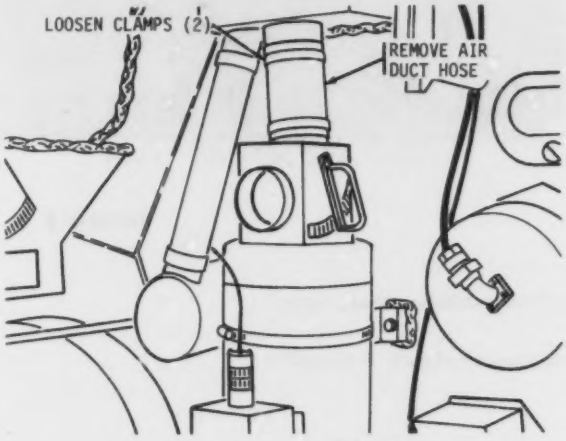
c. Installation. Install the APU in reverse order of removal.



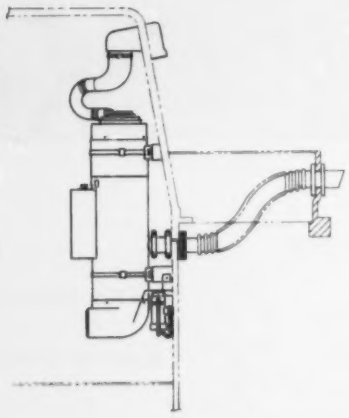
VIEW A. GUARD AND TUBING


DISCONNECT TUBING AND REMOVE
REMOVE SCREWS (2) LOCKWASHERS (2)
DISCONNECT TUBING AND REMOVE (SEE VIEW A)
REMOVE FUEL FILTER
NOTE: REF. TM9-2350-256-20 FOR SERVICING OF FUEL FILTER.

VIEW B. TUBING AND FILTER



VIEW C. AIR DUCT HOSE



VIEW D. AIR DUCT HOSE (OPTIONAL HEATER)

TA171397

Figure 2-5. Personnel heater fuel filter and air duct hose—removal and installation.

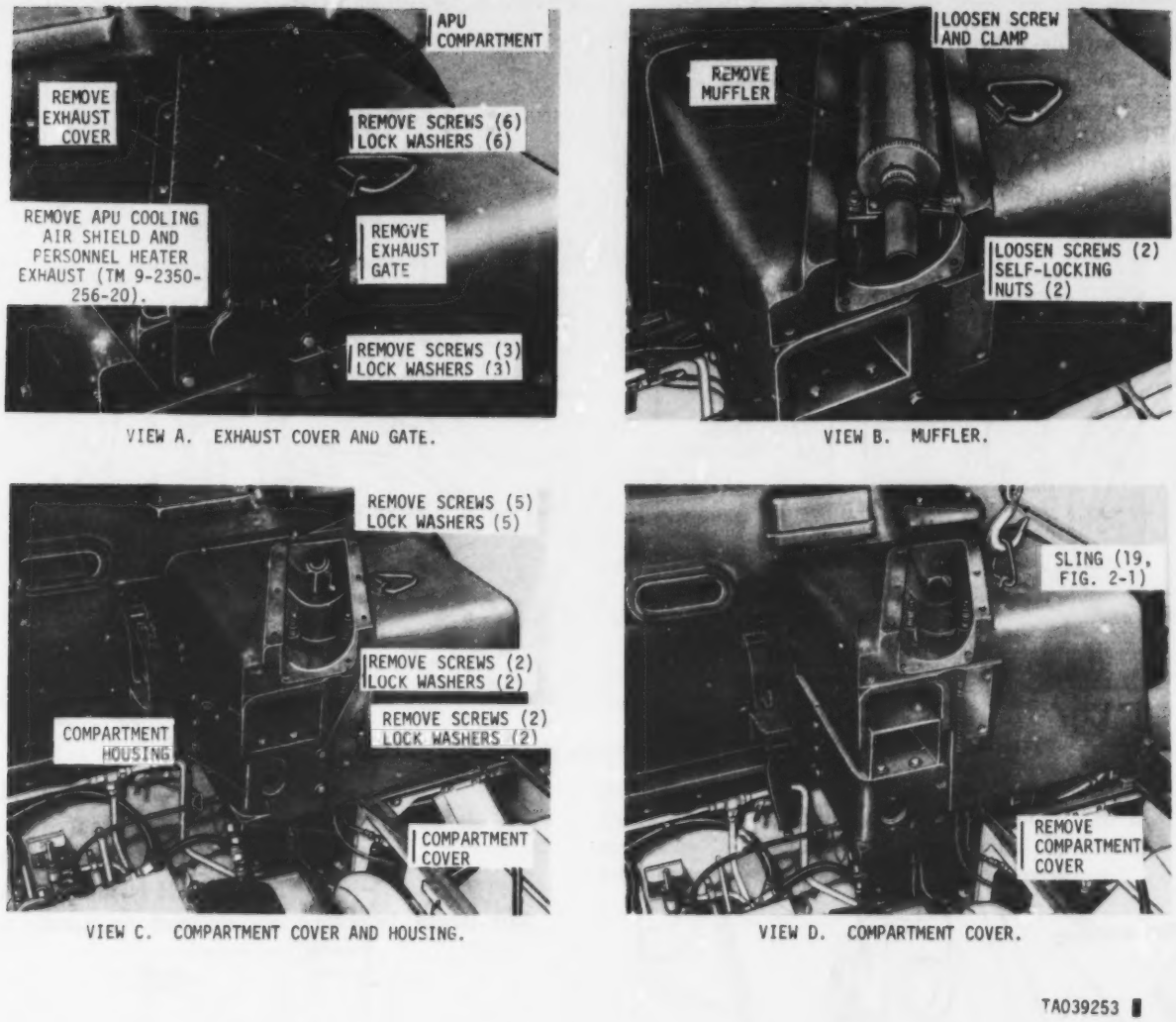
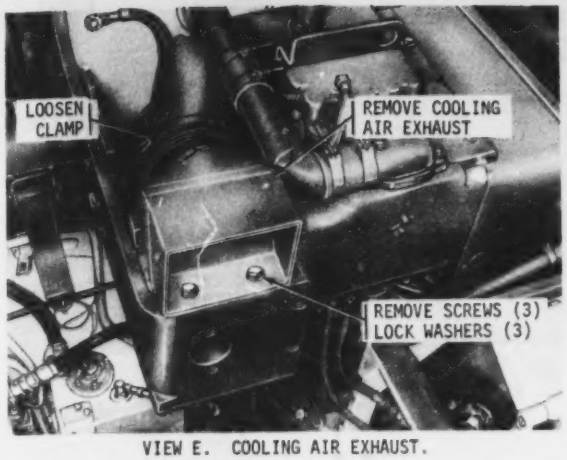
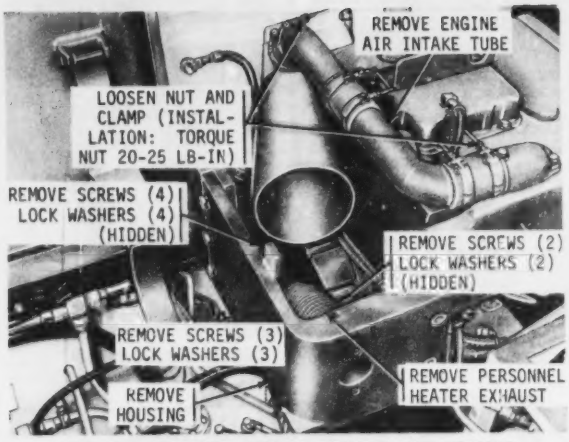

APU COMPARTMENT
REMOVE EXHAUST COVER
REMOVE SCREWS (6) LOCK WASHERS (6)
REMOVE APU COOLING AIR SHIELD AND PERSONNEL HEATER EXHAUST (TM 9-2350-256-20).
REMOVE EXHAUST GATE
REMOVE SCREWS (3) LOCK WASHERS (3)
VIEW A. EXHAUST COVER AND GATE.
LOOSEN SCREW AND CLAMP
REMOVE MUFFLER
LOOSEN SCREWS (2) SELF-LOCKING NUTS (2)
VIEW B. MUFFLER.
REMOVE SCREWS (5) LOCK WASHERS (5)
REMOVE SCREWS (2) LOCK WASHERS (2)
REMOVE SCREWS (2) LOCK WASHERS (2)
COMPARTMENT HOUSING
COMPARTMENT COVER
VIEW C. COMPARTMENT COVER AND HOUSING.
SLING (19, FIG. 2-1)
REMOVE COMPARTMENT COVER
VIEW D. COMPARTMENT COVER.
TA039253

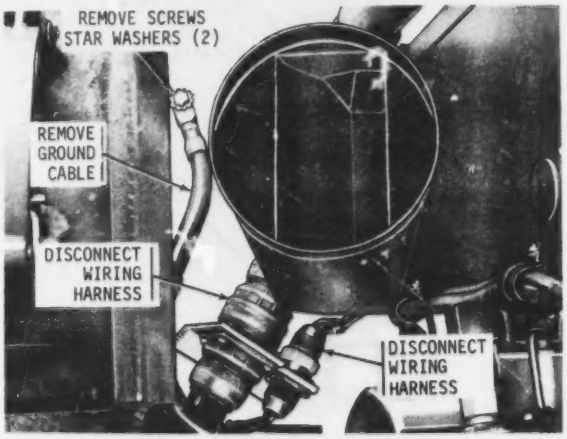
Figure 2-6. Auxiliary power unit—removal and installation (Sheet 1 of 3).



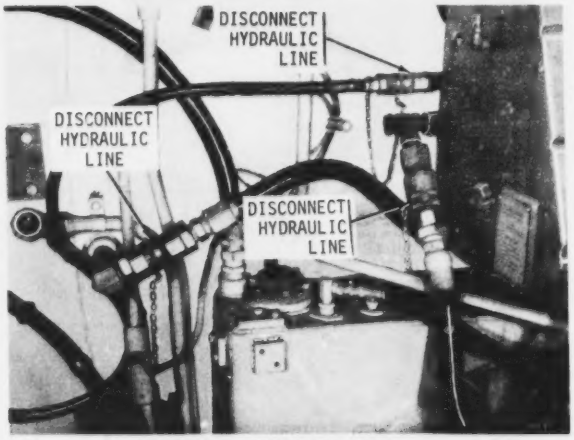
VIEW E. COOLING AIR EXHAUST.


REMOVE ENGINE AIR INTAKE TUBE
LOOSEN NUT AND CLAMP (INSTALLATION: TORQUE NUT 20-25 LB-IN)
REMOVE SCREWS (4) LOCK WASHERS (4) (HIDDEN)
REMOVE SCREWS (2) LOCK WASHERS (2) (HIDDEN)
REMOVE SCREWS (3) LOCK WASHERS (3)
REMOVE HOUSING
REMOVE PERSONNEL HEATER EXHAUST

VIEW F. PERSONNEL HEATER EXHAUST, APU HOUSING AND ENGINE AIR INTAKE TUBE.



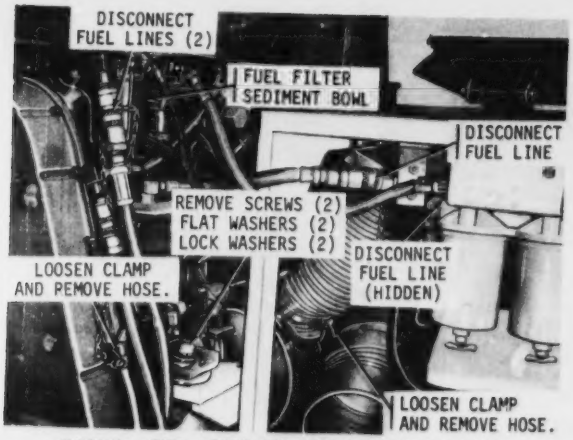
VIEW G. ELECTRICAL CONNECTIONS.



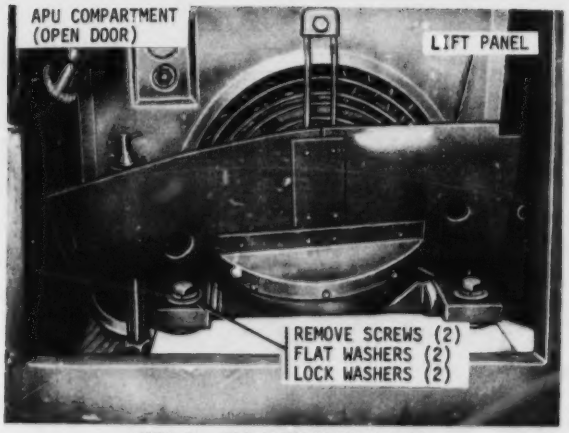
VIEW H. HYDRAULIC LINES.

TA016169

Figure 2-6. Auxiliary power unit—removal and installation (Sheet 2 of 3).


DISCONNECT FUEL LINES (2)
FUEL FILTER SEDIMENT BOWL
DISCONNECT FUEL LINE
REMOVE SCREWS (2) FLAT WASHERS (2) LOCK WASHERS (2)
DISCONNECT FUEL LINE (HIDDEN)
LOOSEN CLAMP AND REMOVE HOSE.
LOOSEN CLAMP AND REMOVE HOSE.

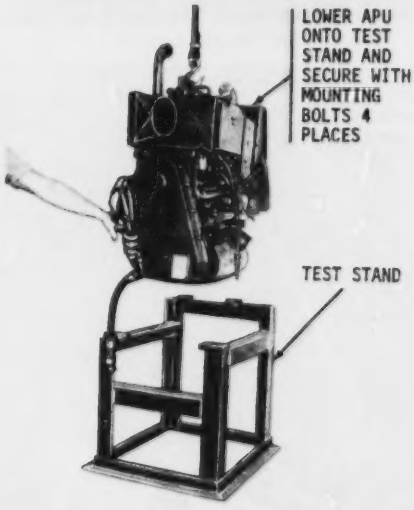
VIEW I. FUEL LINES AND REAR MOUNTING SCREWS.



VIEW J. FRONT MOUNTING SCREWS.

NOTE: DURING INSTALLATION, CAREFULLY GUIDE APU INTO PROPER POSITION IN COMPARTMENT.
ATTACH SLING (19, FIG. 2-1) TO LIFTING EYE AND REMOVE APU FROM VEHICLE

VIEW K. AUXILIARY POWER UNIT REMOVAL.



VIEW L. APU TEST STAND.

TA016193

Figure 2-6. Auxiliary power unit—removal and installation (Sheet 3 of 3).

2-15.1. Auxiliary Power Unit and Main Engine Both Inoperable

If the auxiliary power unit and main engine are both inoperable, refer to TM 9-2350-256-20 for boom elevating instructions.

WARNING

Elevating the hoisting boom when both the auxiliary power unit and main engine are inoperable is a safety hazard and may cause injury to personnel.

2-16. Powerplant

a. Removal. Refer to TM 9-2350-256-20 for removal and installation instructions and for separating the transmission from the main engine.

b. Main Engine Fuel Pump. Refer to TM 9-2350-256-20 for removal, installation and test of the main fuel pump and the main engine fuel injector pump.

2-17. Controls and Linkages

Refer to TM 9-2350-256-20 for disassembly, repair and installation of the steer and shift, service brake and accelerator controls and linkages.

2-18. Left Rear Fuel Tank

a. General. Before removing any fuel tank, drain or pump out tank to remove all fuel (TM 9-2350-256-20). Leave tank vents or filler cap open to allow fuel vapors to escape.

Perform work outdoors whenever possible.

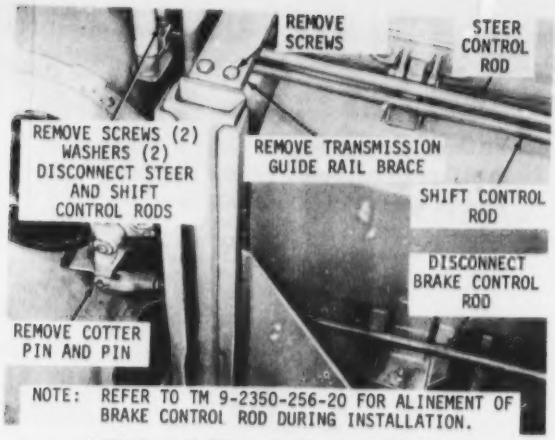
WARNING

Fuel vapor is highly explosive. Every precaution should be used to prevent striking sparks and to keep open flame away from the vicinity of the vehicle when removing fuel tanks.

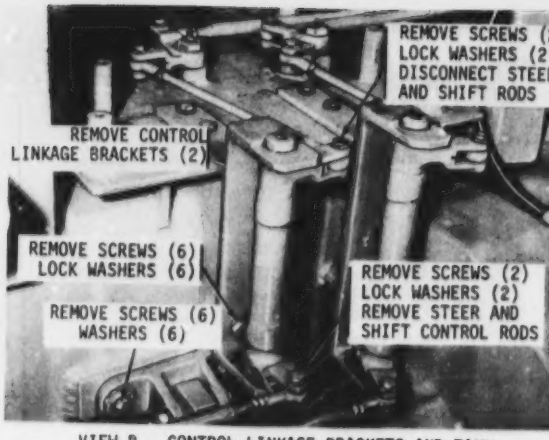
b. Removal. Prior to removal of the left rear fuel tank, remove the engine deck and powerplant (TM 9-2350-256-20). Remove the left rear fuel tank as shown in figure 2-7.

NOTE

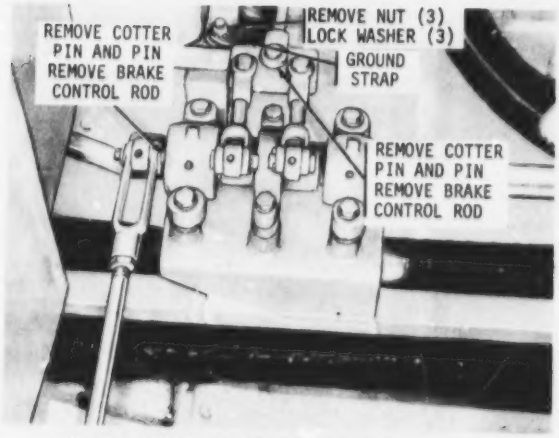
Fittings and accessories may be removed for ventilation purposes before the tank is removed. Refer to TM 9-2350-256-20.


REMOVE SCREWS
STEER CONTROL ROD
REMOVE SCREWS (2) WASHERS (2) DISCONNECT STEER AND SHIFT CONTROL RODS
REMOVE TRANSMISSION GUIDE RAIL BRACE
SHIFT CONTROL ROD
DISCONNECT BRAKE CONTROL ROD
REMOVE COTTER PIN AND PIN
NOTE: REFER TO TM 9-2350-256-20 FOR ALINEMENT OF BRAKE CONTROL ROD DURING INSTALLATION.

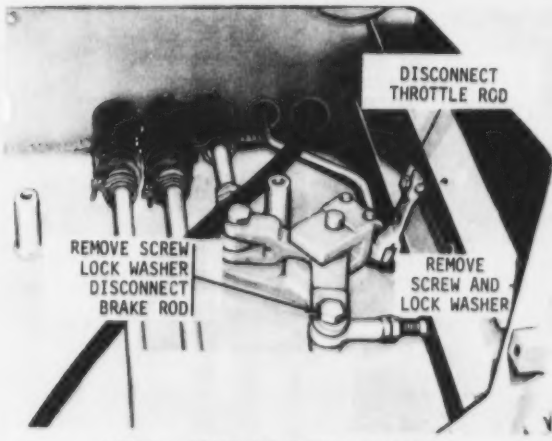
VIEW A. CONTROL LINKAGE AND BRACE.


REMOVE SCREWS (
LOCK WASHERS (2
DISCONNECT STEE
AND SHIFT RODS
REMOVE CONTROL LINKAGE BRACKETS (2)
REMOVE SCREWS (6) LOCK WASHERS (6)
REMOVE SCREWS (6) WASHERS (6)
REMOVE SCREWS (2) LOCK WASHERS (2) REMOVE STEER AND SHIFT CONTROL RODS

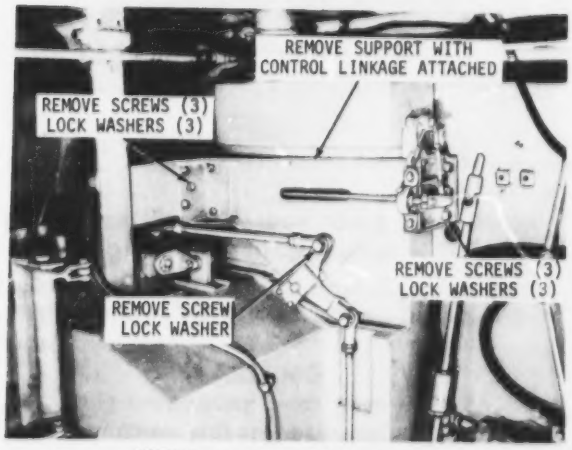
VIEW B. CONTROL LINKAGE BRACKETS AND TANK ATTACHING HARDWARE.


REMOVE COTTER PIN AND PIN REMOVE BRAKE CONTROL ROD
REMOVE NUT (3) LOCK WASHER (3)
GROUND STRAP
REMOVE COTTER PIN AND PIN REMOVE BRAKE CONTROL ROD

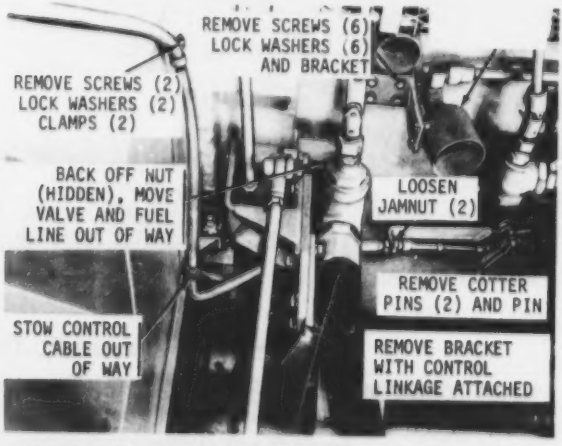
VIEW C. BRAKE CONTROL LINKAGE AND TANK ATTACHING HARDWARE.



VIEW D. BRAKE AND THROTTLE CONTROL.


REMOVE SUPPORT WITH CONTROL LINKAGE ATTACHED
REMOVE SCREWS (3) LOCK WASHERS (3)
REMOVE SCREWS (3) LOCK WASHERS (3)
REMOVE SCREW LOCK WASHER

VIEW E. CONTROL ROD SUPPORT.


REMOVE SCREWS (6) LOCK WASHERS (6) AND BRACKET
REMOVE SCREWS (2) LOCK WASHERS (2) CLAMPS (2)
BACK OFF NUT (HIDDEN), MOVE VALVE AND FUEL LINE OUT OF WAY
LOOSEN JAMNUT (2)
REMOVE COTTER PINS (2) AND PIN
STOW CONTROL CABLE OUT OF WAY
REMOVE BRACKET WITH CONTROL LINKAGE ATTACHED

VIEW F. FUEL LINE, CONTROL CABLE AND CONTROL LINKAGE BRACKET.

TA016144

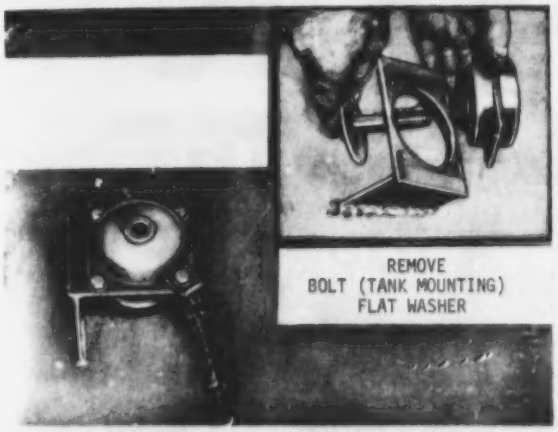
Figure 2-7. Left rear fuel tank—removal and installation (Sheet 1 of 2).

NOTE: USE TAPE OR OTHER MATERIAL TO COVER TANK AND LINE OPENINGS. DO NOT STUFF WITH RAGS.

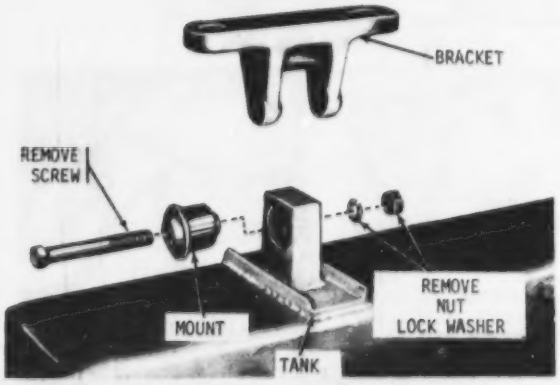
VIEW G. FUEL LINES AND FILLER NECK (REF. TM 9-2350-256-20).

ATTACH SLING (19, FIG. 2-1) AND SUITABLE CABLE TO TOP MOUNTS
ATTACH TO FUEL OUTLET FITTING FOR STABILITY
MOVE TANK REARWARD, SWING FRONT AWAY FROM VEHICLE WALL, AND KEEP LEVEL WHILE LIFTING STRAIGHT UP

VIEW H. REMOVING TANK.



VIEW I. REPLACING TANK FLOOR MOUNT CUSHIONS. (TYPICAL FOR RIGHT REAR AND FORWARD TANKS).



VIEW J. REPLACING TANK UPPER MOUNT CUSHIONS. (TYPICAL OF RIGHT REAR AND FORWARD TANKS)

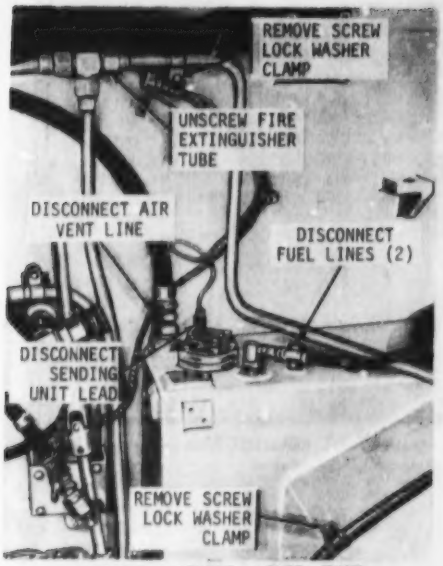
TA016145

Figure 2-7. Left rear fuel tank—removal and installation (Sheet 2 of 2).

c. Installation. Install the left rear fuel tank in reverse order of removal.

2-19. Right Rear Fuel Tank

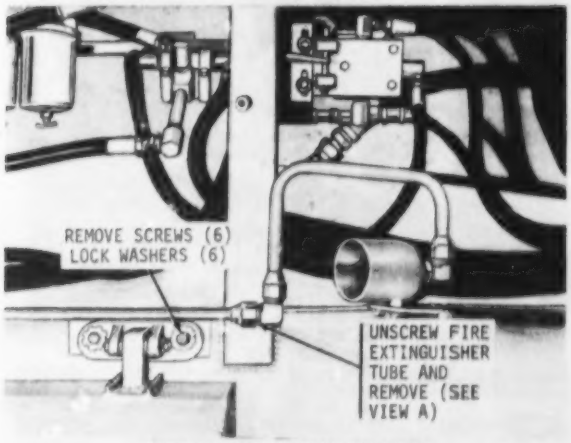
Procedure for removal and installation of the right rear fuel tank is essentially the same as for left fuel tank (para 2-18 *a* and *b*) except there is no filler neck to remove and the sending unit may be removed and installed while the tank is either in or out of the vehicle. The auxiliary power unit must be removed prior to removal of the right rear fuel tank (para 2-15). Remove or install the right rear fuel tank as shown in figure 2-8.


REMOVE SCREW LOCK WASHER CLAMP
UNSCREW FIRE EXTINGUISHER TUBE
DISCONNECT AIR VENT LINE
DISCONNECT FUEL LINES (2)
DISCONNECT SENDING UNIT LEAD
REMOVE SCREW LOCK WASHER CLAMP

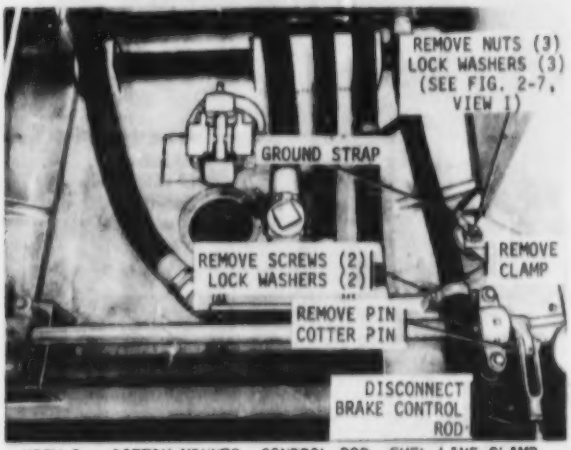
VIEW A. WIRING, LINES, TUBE.

DISCONNECT COTTER PIN AND PIN
BACK OFF NUT
REMOVE FUEL VALVE AND FITTINGS AND FLEX 2 FUEL LINES OUT OF WAY
FLEX LINE DOWN OUT OF WAY
REMOVE SCREW LOCK WASHER CLAMP

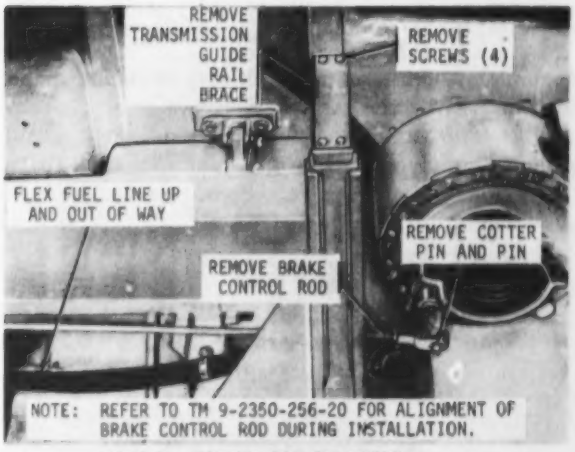
VIEW B. FUEL LINES.



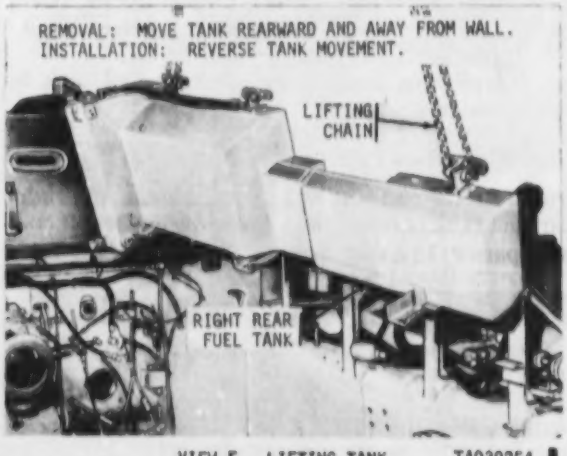
VIEW C. TOP MOUNTS AND TUBE.


REMOVE NUTS (3) LOCK WASHERS (3) (SEE FIG. 2-7, VIEW I)
GROUND STRAP
REMOVE SCREWS (2) LOCK WASHERS (2)
REMOVE CLAMP
REMOVE PIN COTTER PIN
DISCONNECT BRAKE CONTROL ROD

VIEW D. BOTTOM MOUNTS, CONTROL ROD, FUEL LINE CLAMP.


REMOVE TRANSMISSION GUIDE RAIL BRACE
REMOVE SCREWS (4)
FLEX FUEL LINE UP AND OUT OF WAY
REMOVE COTTER PIN AND PIN
REMOVE BRAKE CONTROL ROD
NOTE: REFER TO TM 9-2350-256-20 FOR ALIGNMENT OF BRAKE CONTROL ROD DURING INSTALLATION.

VIEW E. CONTROL ROD AND BRACE.



VIEW F. LIFTING TANK. TA039254

Figure 2-8. Right rear fuel tank—removal and installation.

2-20. Mechanical Tachometer and Speedometer Assembly

Deleted

Figure 2-9. Deleted.

2-21. Electrical Components

a. General. The electrical components allocated for replacement by direct and general support maintenance personnel are the high voltage power pack, bilge pump electrical system components and the miscellaneous leads and wiring harnesses comprising the vehicle electrical installation. The circuit number of each cable is shown on a metal band attached to the junction of terminal end of each cable. Refer to TM 9-2350-256-20 for a listing of the circuit numbers assigned to the vehicle and for the vehicle wiring diagram.

WARNING

Certain precautions must be observed when removing electrical components. Accidental contact of metal tools between battery or starter cables and the frame of the vehicle causes a direct short circuit resulting in arcing and instant heating of the tool to red hot. This can cause painful burns on the hands and serious damage to tools, vehicle components and batteries. Moreover, the overloaded battery may explode, spraying hot acid and sharp fragments over the surrounding area. The correct procedure when removing electrical equipment, harnesses, leads or cables is to first turn off the master switch and then disconnect the battery ground cables. Protect the ground cables from accidental contact with the battery terminals. When the work has been completed, connect the battery ground cables last.

CAUTION

When removing harnesses, leads and cables, check circuit number markers. If any are missing, illegible or damaged to the extent that they might come off, tag cables with correct circuit numbers (refer to applicable wiring or schematic diagrams in this chapter or the vehicle wiring diagram in TM 9-2350-256-20) prior to disconnecting them.

b. Deleted.

Figure 2-10. Deleted.

c. Deleted.

Figure 2-11. Deleted.

d. Deleted.

e. Bilge Pump Electrical System Components.

(1) *Removal.* Remove the bilge pump circuit breaker, relay, wiring harness and power lead as shown in figure 2-13.

Figure 2-12. Deleted.

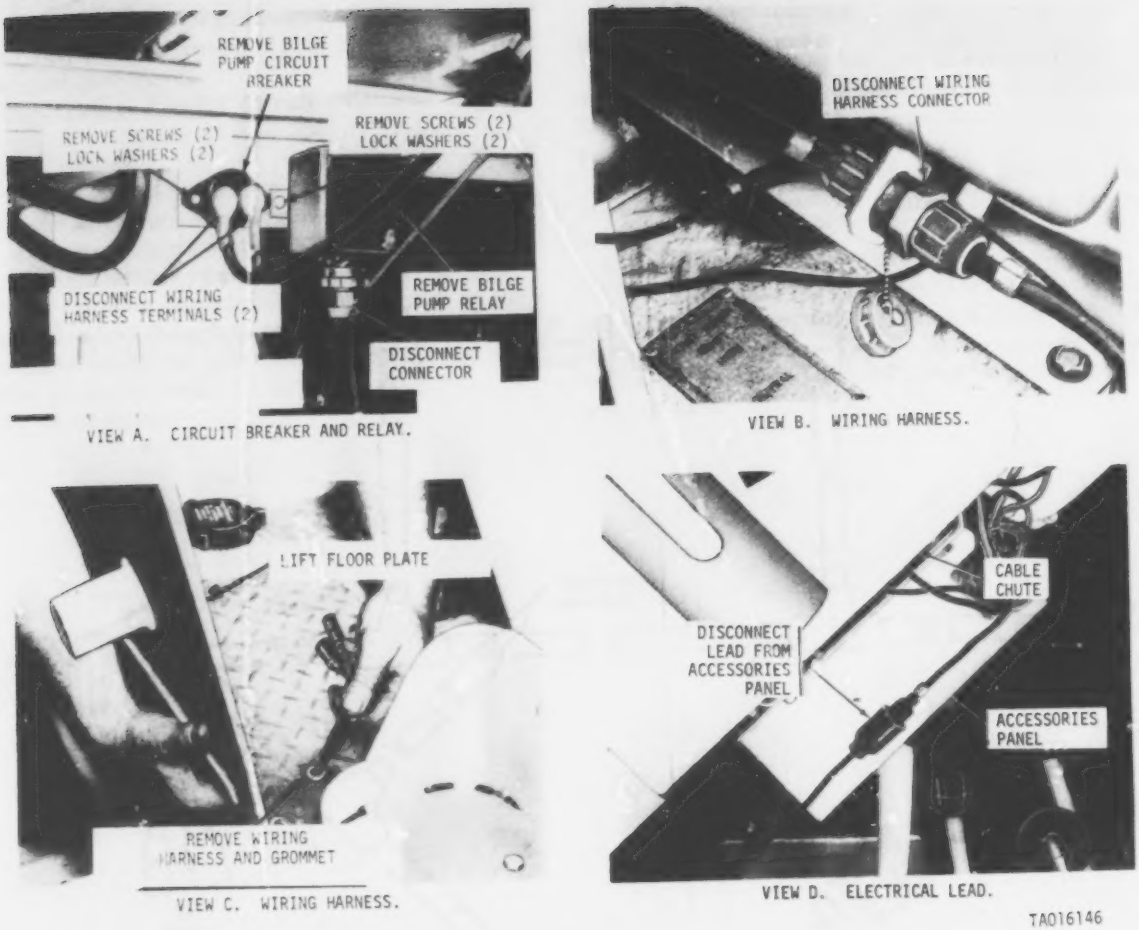

REMOVE BILGE PUMP CIRCUIT BREAKER
REMOVE SCREWS (2) LOCK WASHERS (2)
REMOVE SCREWS (2) LOCK WASHERS (2)
DISCONNECT WIRING HARNESS TERMINALS (2)
REMOVE BILGE PUMP RELAY
DISCONNECT CONNECTOR
VIEW A. CIRCUIT BREAKER AND RELAY.
DISCONNECT WIRING HARNESS CONNECTOR
VIEW B. WIRING HARNESS.
LIFT FLOOR PLATE
REMOVE WIRING HARNESS AND GROMMET
VIEW C. WIRING HARNESS.
CABLE CHUTE
DISCONNECT LEAD FROM ACCESSORIES PANEL
ACCESSORIES PANEL
VIEW D. ELECTRICAL LEAD.
TA016146

Figure 2-13. Bilge pump electrical system components—removal and installation.

(2) *Installation.* Install the various bilge pump electrical components in reverse order of removal.

f. Master Relay, Voltage Regulator, Main Engine Disconnect, and Slave Receptacle Cable Assembly.

(1) *Removal.* Refer to figure 2-14 and remove the cable assembly as described in (a) through (k) below.

WARNING

Steps (a) and (b) must be performed in the sequence described to avoid injury to personnel or damage to vehicle electrical components resulting from short circuit and arcing.

(a) Disconnect battery ground cables (TM 9-2350-256-20).

(b) Disconnect two terminal lugs from vehicle batteries.

(c) Disconnect cable connector from main engine voltage regulator.

(d) Disconnect cable connector from master relay.

(e) Disconnect cable connector at main engine disconnect.

(f) Disconnect two cable connectors from powerplant wiring harness.

(g) Disconnect two terminal lugs from slave receptacle.

(h) Disconnect cable connector from APU voltage regulator.

(i) Disconnect GND lug to voltage regulator.

(j) Disconnect GND cable connector to harness 11672412.

(k) Loosen or remove all cable clamps that attach cable assembly to bulkhead and remove cable assembly.

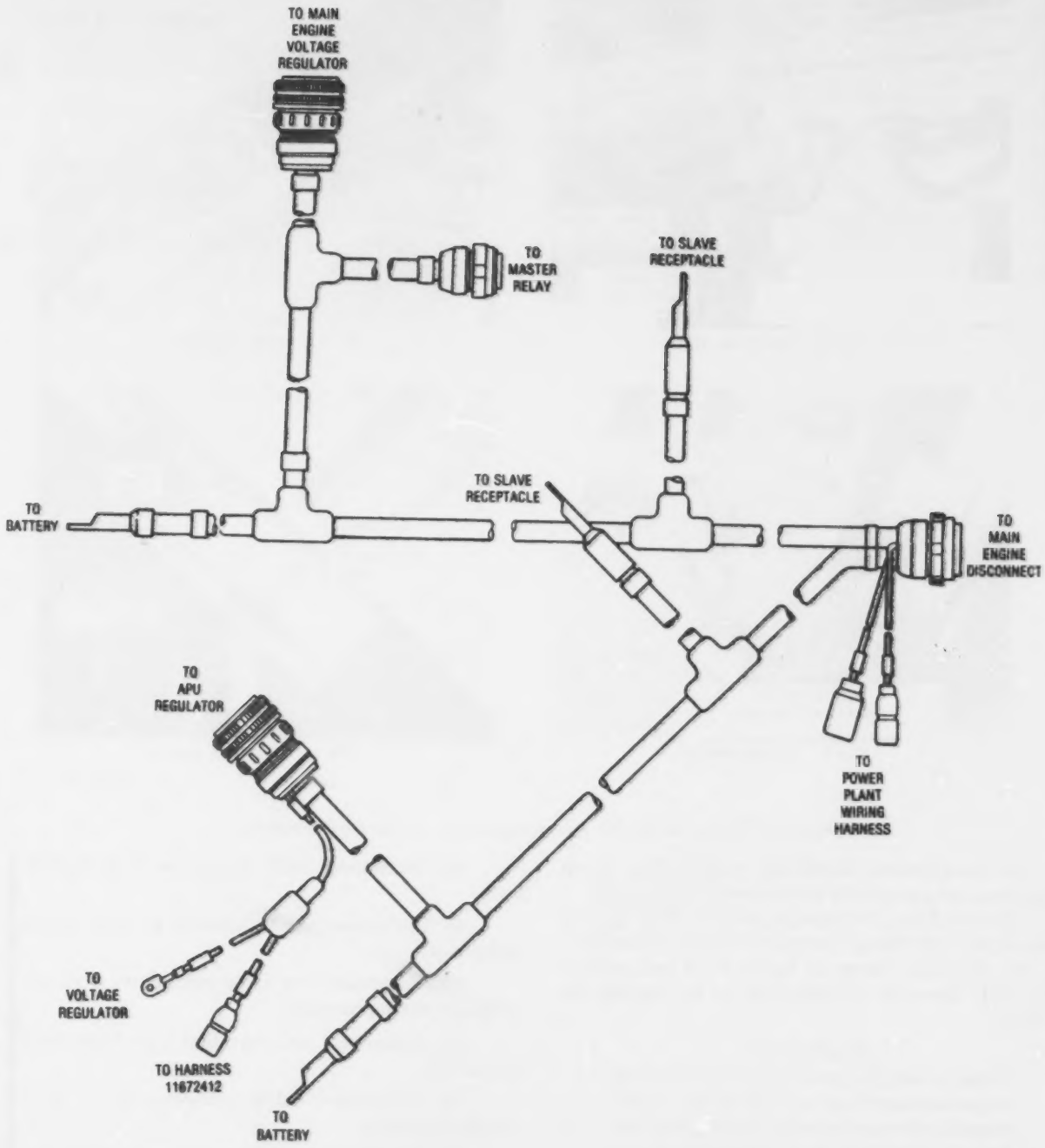


Figure 2-14. Batteries to master relay, main engine and APU, voltage regulators, main engine disconnect and slave receptacle cable assembly—removal and installation.

Legend for fig. 2-14: Deleted

(2) *Installation.* Install cable assembly in reverse order of removal.

g. Emergency Flasher Circuit (No. 325) Wiring Harness.

(1) *Removal.*

(a) Disconnect the harness from the left front red flasher indicator lamp. Remove the shell, washer, and ferrule from the cable (fig. 3-20) so that cable can slide through narrow opening.

(b) Remove interfering components as required for access at various points. Disconnect cable connectors, loosen, or remove any cable clamps and remove wiring harness.

(2) *Installation.*

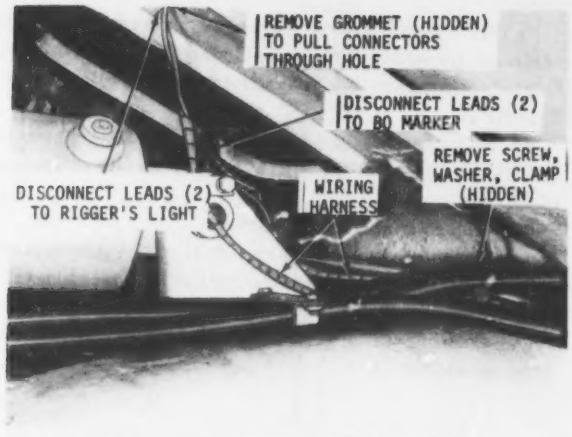
(a) Replace missing or defective chassis grommets.

(b) Install wiring harness in reverse order of removal, threading the cable through to the front red flasher indicator lamp without the connector installed.

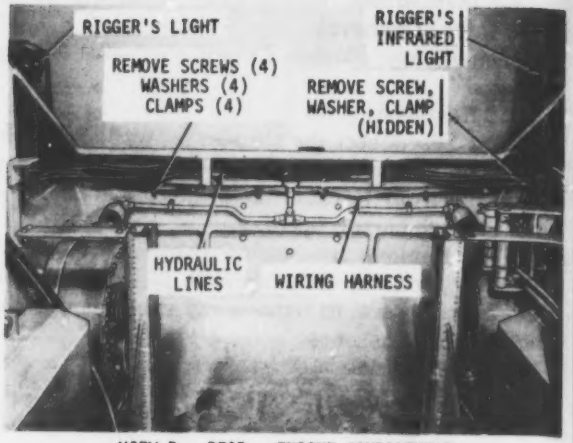
(c) Install the ferrule, washer, and shell as shown in figure 3-20 and connect to the indicator lamp.

h. Powerplant Wiring Harness.

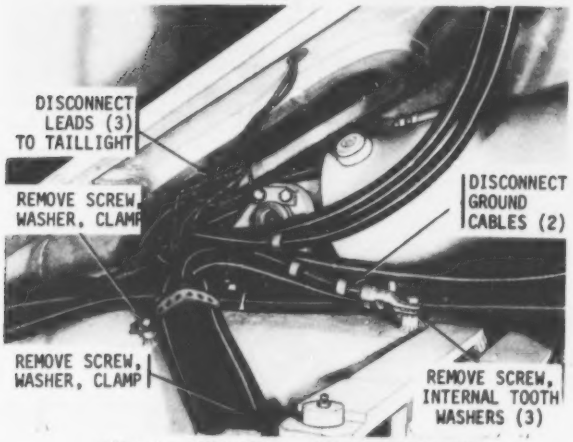
(1) *Removal.* Prior to removal of the powerplant wiring harness, remove engine deck assembly (TM 9-2350-256-20). Remove interfering components as required for access. Remove powerplant wiring harness as shown in


REMOVE GROMMET (HIDDEN) TO PULL CONNECTORS THROUGH HOLE
DISCONNECT LEADS (2) TO BO MARKER
REMOVE SCREW, WASHER, CLAMP (HIDDEN)
DISCONNECT LEADS (2) TO RIGGER'S LIGHT
WIRING HARNESS

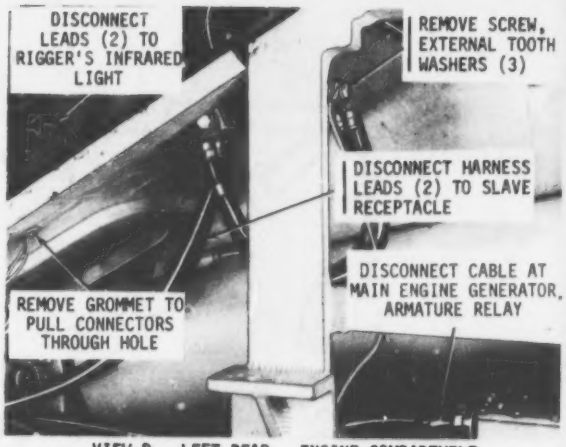
VIEW A. RIGHT REAR - ENGINE COMPARTMENT.



VIEW B. REAR - ENGINE COMPARTMENT.


DISCONNECT LEADS (3) TO TAILLIGHT
REMOVE SCREW, WASHER, CLAMP
DISCONNECT GROUND CABLES (2)
REMOVE SCREW, WASHER, CLAMP
REMOVE SCREW, INTERNAL TOOTH WASHERS (3)

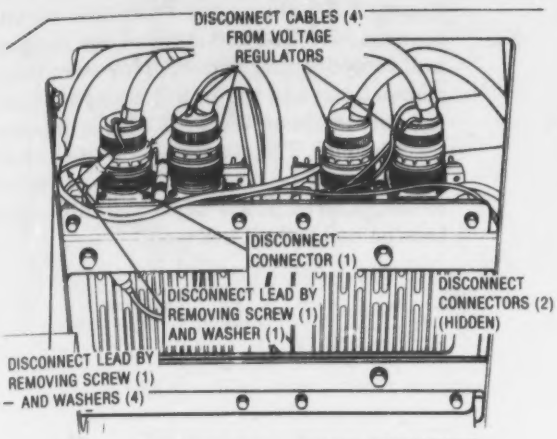
VIEW C. LEFT REAR - ENGINE COMPARTMENT.


DISCONNECT LEADS (2) TO RIGGER'S INFRARED LIGHT
REMOVE SCREW, EXTERNAL TOOTH WASHERS (3)
DISCONNECT HARNESS LEADS (2) TO SLAVE RECEPTACLE
DISCONNECT CABLE AT MAIN ENGINE GENERATOR, ARMATURE RELAY
REMOVE GROMMET TO PULL CONNECTORS THROUGH HOLE

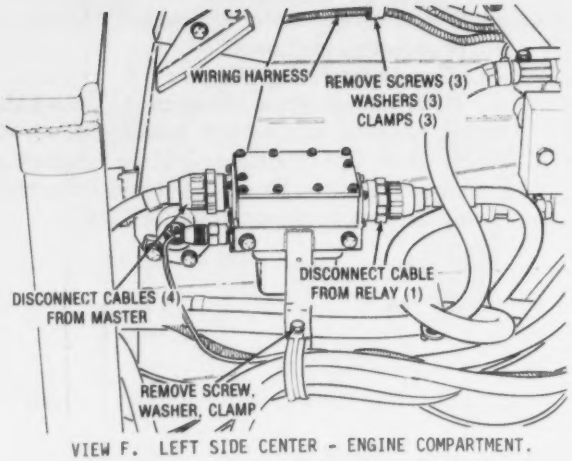
VIEW D. LEFT REAR - ENGINE COMPARTMENT.

TA016128

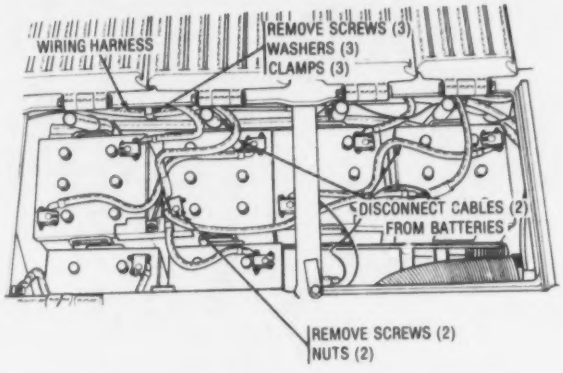
Figure 2-15. Powerplant wiring harness—removal and installation. (Sheet 1 of 2).


DISCONNECT CABLES (4) FROM VOLTAGE REGULATORS
DISCONNECT CONNECTOR (1)
DISCONNECT LEAD BY REMOVING SCREW (1) AND WASHER (1)
DISCONNECT CONNECTORS (2) (HIDDEN)
DISCONNECT LEAD BY REMOVING SCREW (1) AND WASHERS (4)

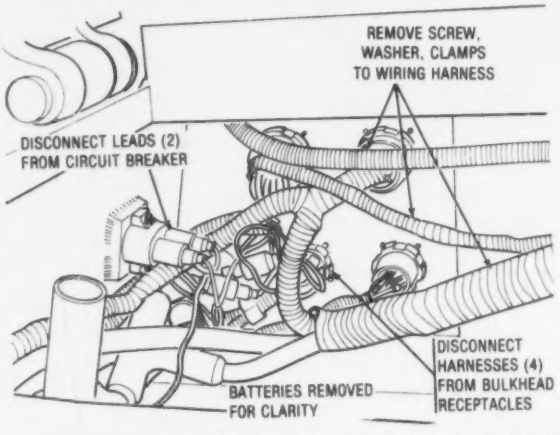
VIEW E. LEFT SIDE REAR - ENGINE COMPARTMENT.


WIRING HARNESS
REMOVE SCREWS (3) WASHERS (3) CLAMPS (3)
DISCONNECT CABLE FROM RELAY (1)
DISCONNECT CABLES (4) FROM MASTER
REMOVE SCREW, WASHER, CLAMP

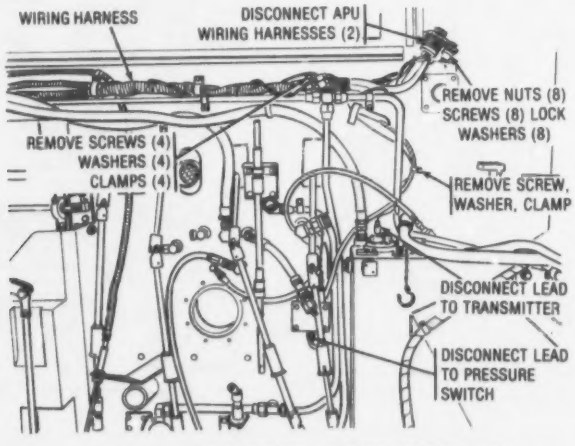
VIEW F. LEFT SIDE CENTER - ENGINE COMPARTMENT.



VIEW G. LEFT SIDE FRONT - ENGINE COMPARTMENT.


REMOVE SCREW, WASHER, CLAMPS TO WIRING HARNESS
DISCONNECT LEADS (2) FROM CIRCUIT BREAKER
DISCONNECT HARNESSES (4) FROM BULKHEAD RECEPTACLES
BATTERIES REMOVED FOR CLARITY

VIEW H. LEFT SIDE FRONT CORNER - ENGINE COMPARTMENT.


WIRING HARNESS
DISCONNECT APU WIRING HARNESSES (2)
REMOVE NUTS (8) SCREWS (8) LOCK WASHERS (8)
REMOVE SCREWS (4) WASHERS (4) CLAMPS (4)
REMOVE SCREW, WASHER, CLAMP
DISCONNECT LEAD TO TRANSMITTER
DISCONNECT LEAD TO PRESSURE SWITCH

VIEW I. RIGHT FRONT - ENGINE COMPARTMENT.

TA171399

Figure 2-15. Powerplant wiring harness—removal and installation (Sheet 2 of 2).

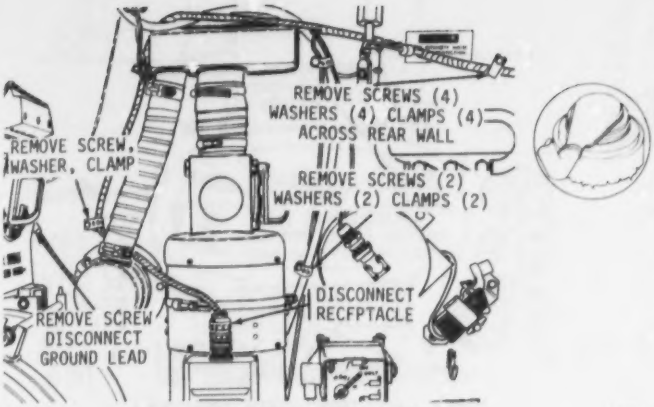
(2) *Installation.* Install the powerplant wiring harness in reverse order of removal, replacing missing or defective grommets.

i. Hull Main Wiring Harness.

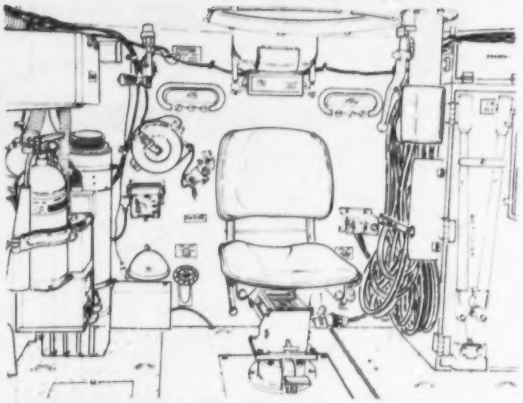
(1) *Removal.* Prior to removal of the hull main wiring harness, remove the vehicle left air cleaner (TM 9-2350-256-20). Remove other interfering components as required for access. Remove the hull main wiring harness as shown in figure 2-16.

NOTE

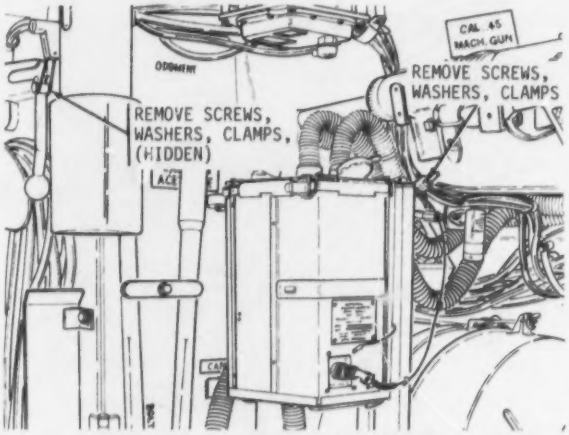
Figure 2-16 shows the hull main wiring harness installed and most of the interior hull components removed. However, most connections and mounting clamps are accessible without removal of the interior components. The stowage rack on the hull left side may be removed for easier access to the infrared power units and cable slips located on the hull left wall.



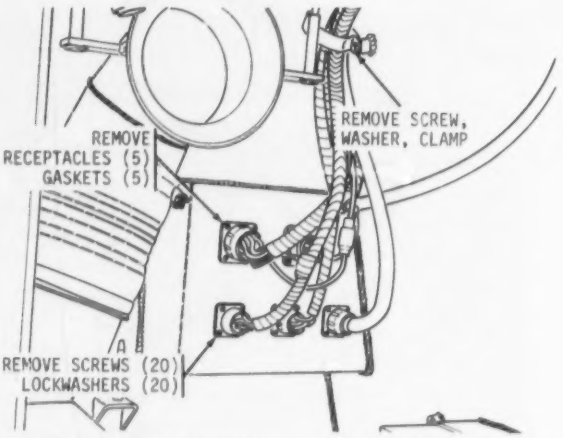
VIEW A. RIGHT REAR - CREW COMPARTMENT



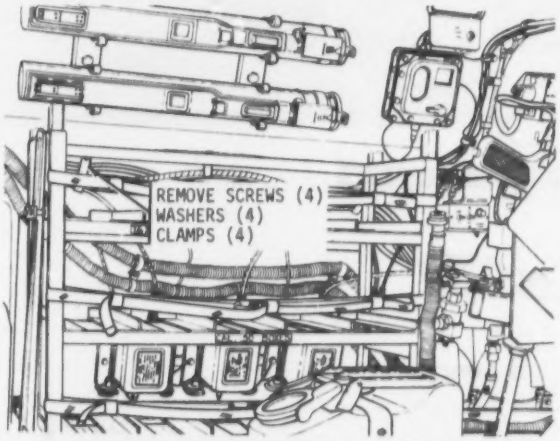
VIEW A-1. RIGHT REAR-CREW COMPARTMENT (OPTIONAL HEATER).



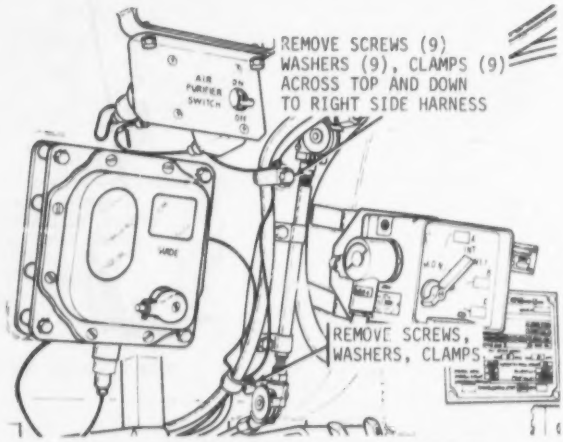
VIEW B. LEFT REAR - CREW COMPARTMENT.



VIEW C. LEFT REAR CORNER - CREW COMPARTMENT.



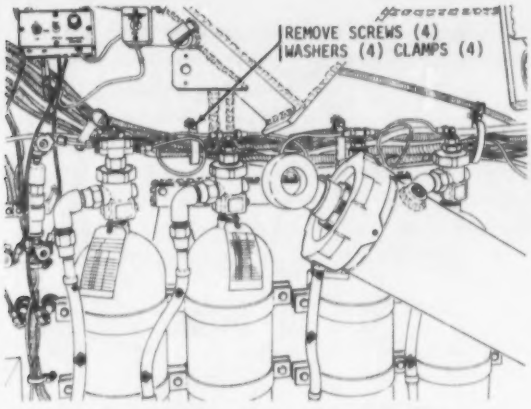
VIEW D. LEFT REAR SIDE - CREW COMPARTMENT.



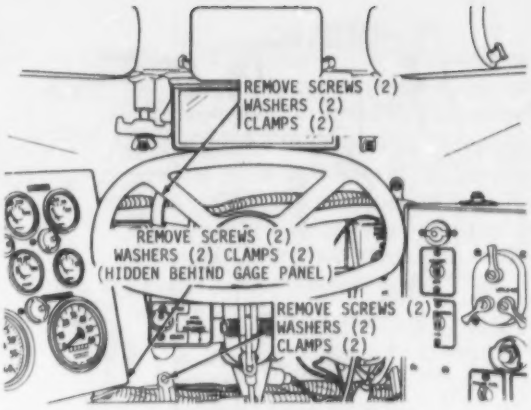
VIEW E. LEFT CENTER SIDE - CREW COMPARTMENT.

TA171400

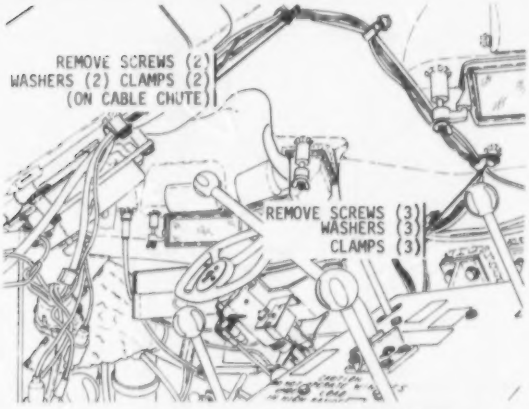
Figure 2-16. Hull main wiring harness—removal and installation (Sheet 1 of 2).



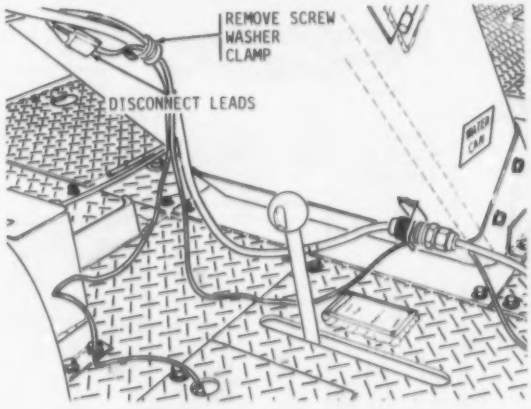
VIEW F. LEFT FRONT SIDE - CREW COMPARTMENT.



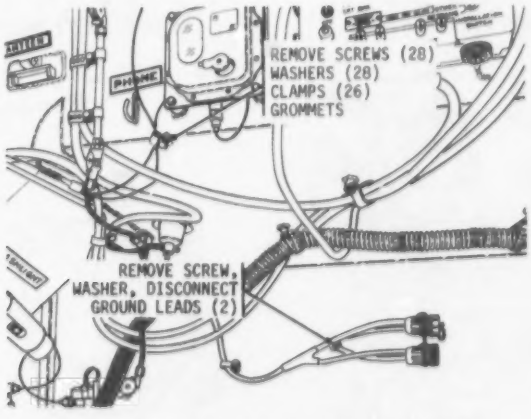
VIEW G. LEFT FRONT - CREW COMPARTMENT.



VIEW H. TOP FRONT CENTER - CREW COMPARTMENT.



VIEW I. BOTTOM FRONT CENTER - CREW COMPARTMENT.



VIEW J. RIGHT CENTER SIDE - CREW COMPARTMENT.

TA171401

Figure 2-16. Hull main wiring harness—removal and installation (Sheet 2 of 2).

(2) *Installation.* Install the hull main wiring harness in reverse order of removal, replacing missing or defective grommets.

j. Gage Panel Wiring Harness and Lead.

(1) *Removal.* Prior to removing the gage panel wiring harness and lead, remove the gage panel fr the vehicle (TM 9-2350-256-20). Remove the wir harness and the lead from the fuel indicator to fuel selector switch as shown in figure 2-17.

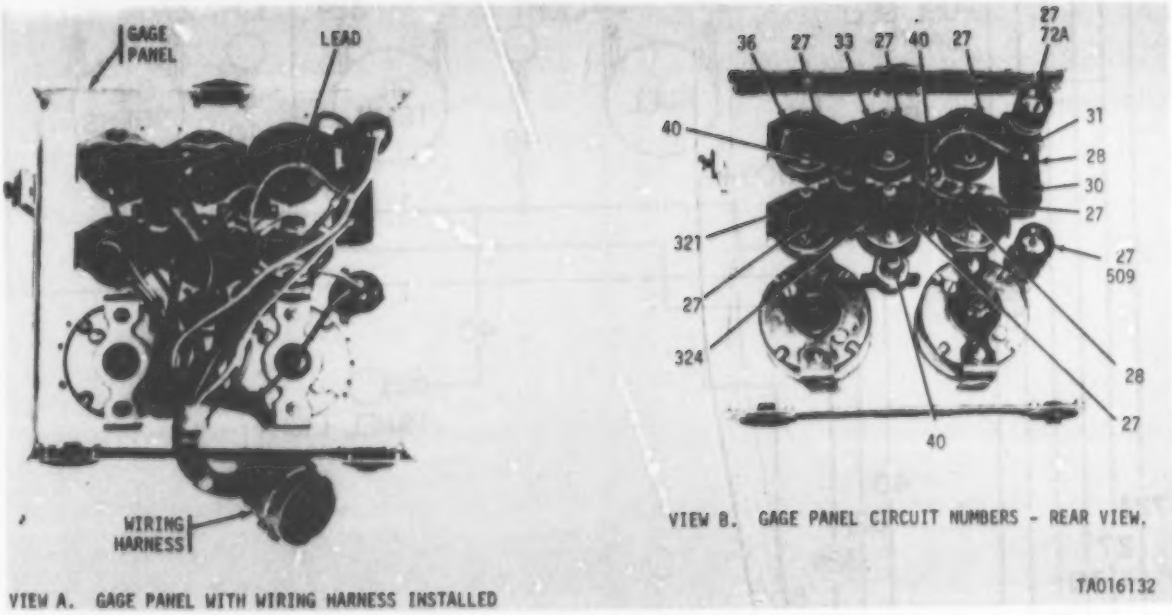
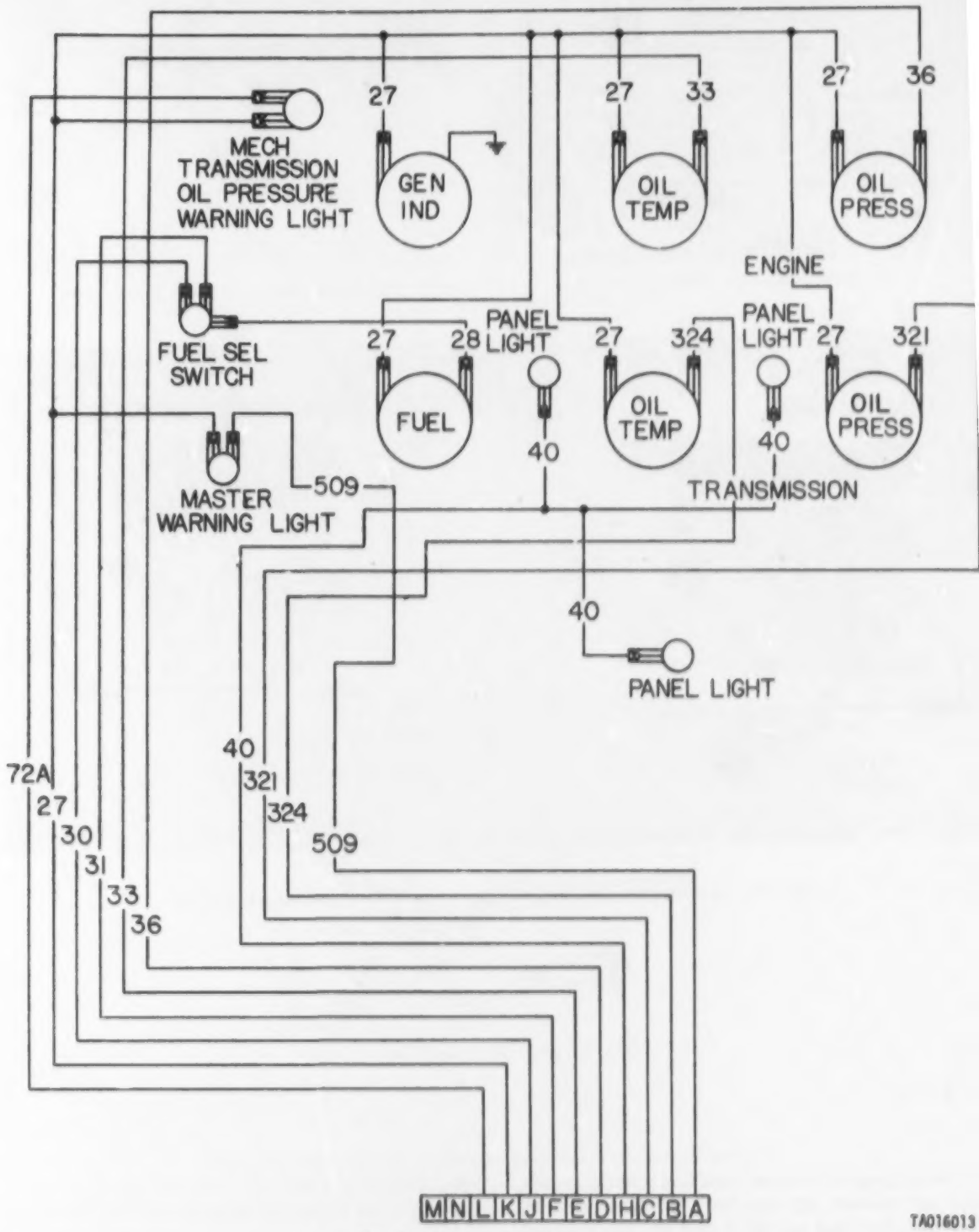


Figure 2-17. Gage panel wiring harness and lead—removal and installation (Sheet 1 of 2).



View C. Gage panel wiring diagram.

Figure 2-17. Gage panel wiring harness and lead—removal and installation (Sheet 2 of 2).

(2) *Installation.* Install the gage panel wiring harness and lead in reverse order of removal, being careful to match circuit number markers to the correct receptacles as shown in View B, figure 2-17.

k. Main Switch Panel Wiring Harnesses and Leads.

(1) *Removal.* Prior to removing the switch panel wiring harnesses and leads, remove the switch panel from the vehicle (TM 9-2350-256-20). Remove three leads (No. 520 connecting No. 520 from the light switch panel connector to the blackout selector, No. 54 from fuel shutoff switch to circuit breaker, and No. 76 from fuel pump switch to circuit breaker) and remove three wiring harnesses as shown in figure 2-18.

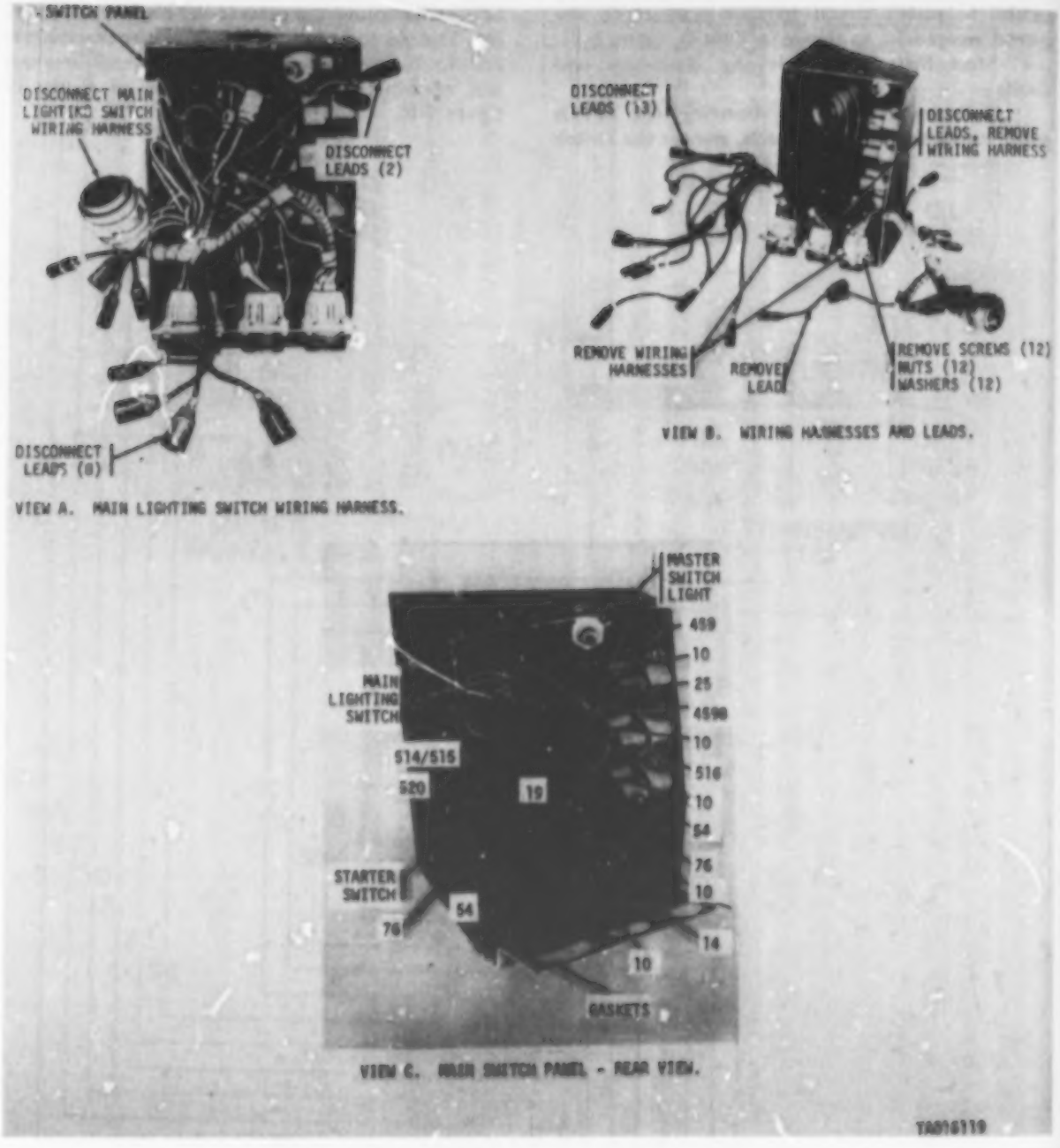
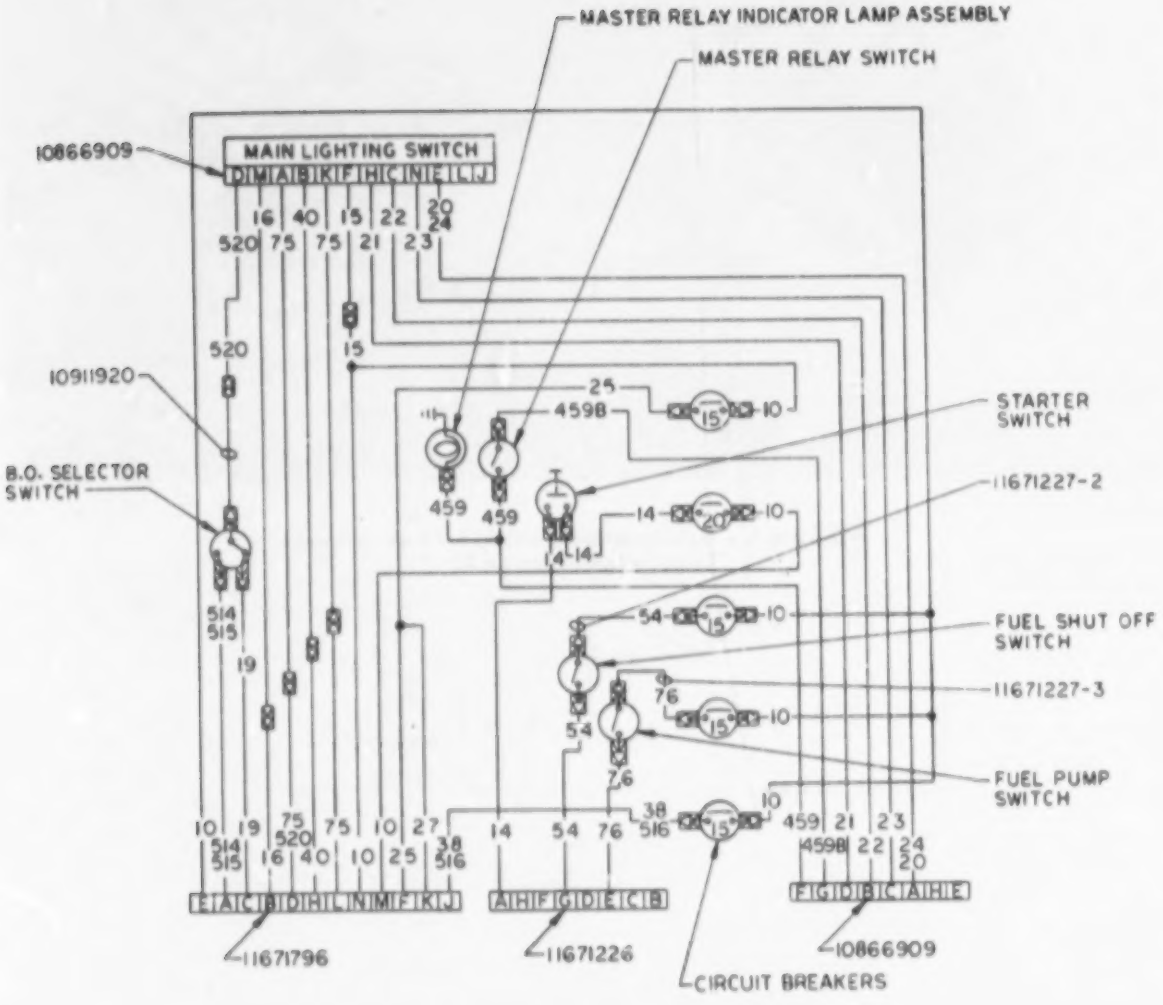


Figure 2-18. Main switching panel wiring harness and leads – removal and installation (Sheet 1 of 2).



View D. Switch panel wiring diagram.

TA015992

Figure 2-18. Main switching panel wiring harness and leads—removal and installation (Sheet 2 of 2).

(2) *Installation.* Install the switch panel wiring harnesses and leads in reverse order of removal, being careful to match circuit number markers to the correct receptacles as shown in View C, figure 2-18.

l. Accessories Panel Wiring Harness and Leads.

(1) *Removal.* Prior to removing the accessories panel wiring harness and leads, remove the accessories panel from the vehicle (TM 9-2350-256-20). Remove the wiring harness assembly and leads as shown in figure 2-19.

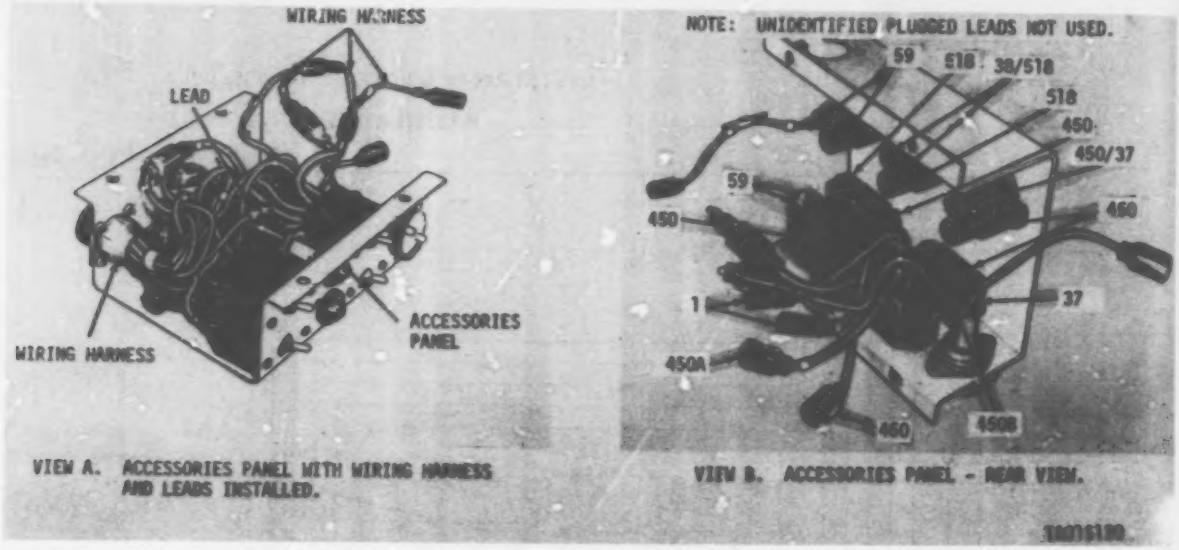
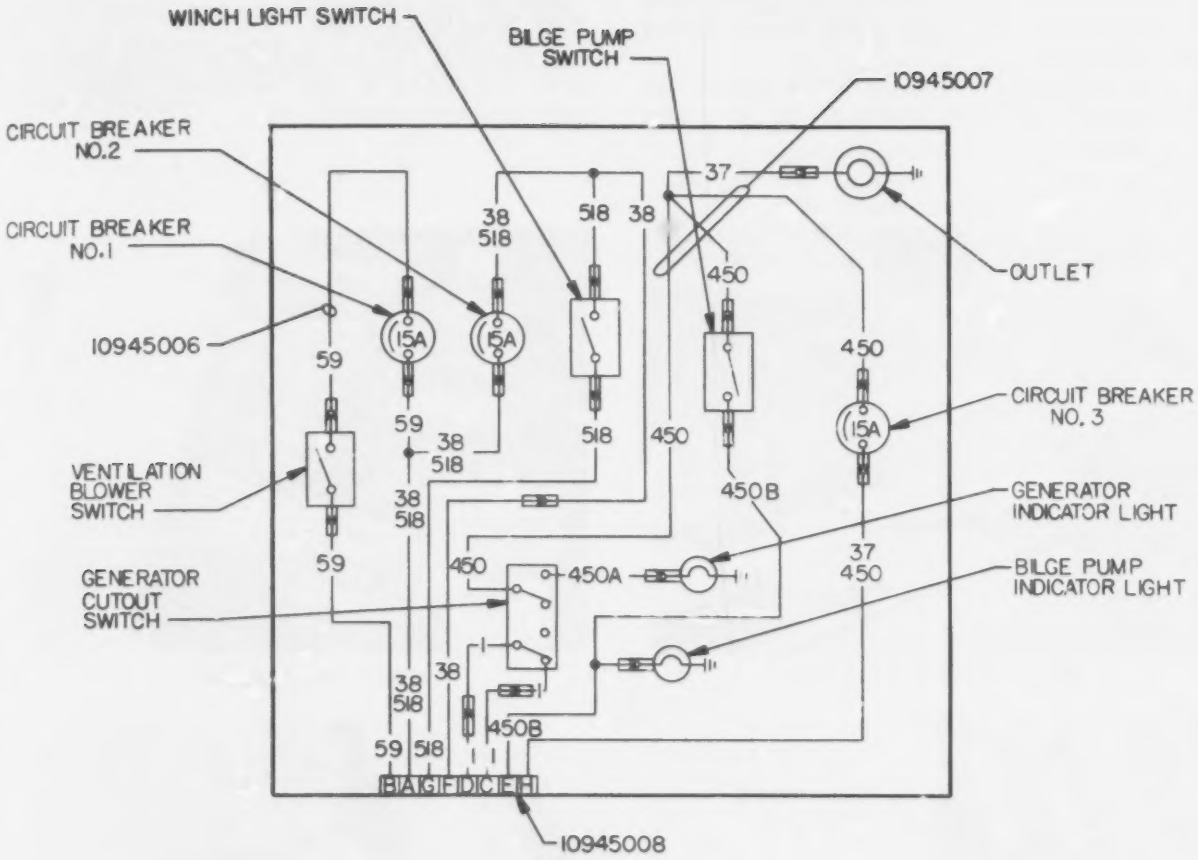


Figure 2-19. Accessories panel wiring harness and leads—removal and installation (Sheet 1 of 2).



View C. Accessories panel wiring diagram.

TA016014

Figure 2-19. Accessories panel wiring harness and leads—removal and installation (Sheet 2 of 2).

(2) *Installation.* Install the accessories panel leads and wiring harness in reverse order of removal, being careful to match circuit number markers to the correct receptacles as shown in View B, figure 2-19.

m. Miscellaneous Individual Wiring Harnesses, Leads and Cables.

(1) *General.* The various wiring harnesses, leads and cables comprising the powerplant and hull main wiring harnesses can be removed individually. Refer to paragraphs 2-21 *f* and *g* for those requiring special handling.

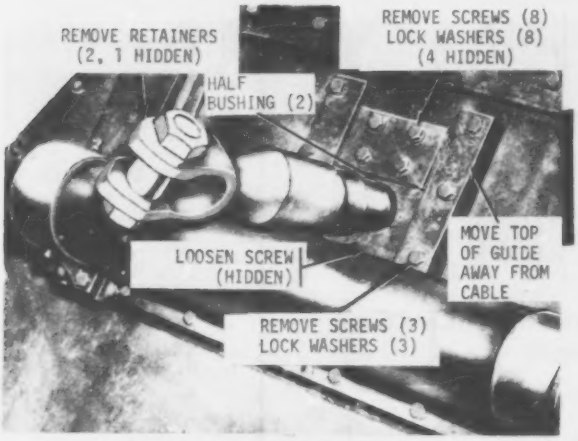
(2) *Removal.* Remove interfering components as required for access at various points. Disconnect cable connectors, loosen or remove any cable clamps and remove wiring harness, lead or cable.

(3) *Installation.* Install wiring harness, lead or cable, tighten or install cable clamps and connect cable connectors in reverse order of removal. Always take care that the cables being connected bear the same circuit numbers.

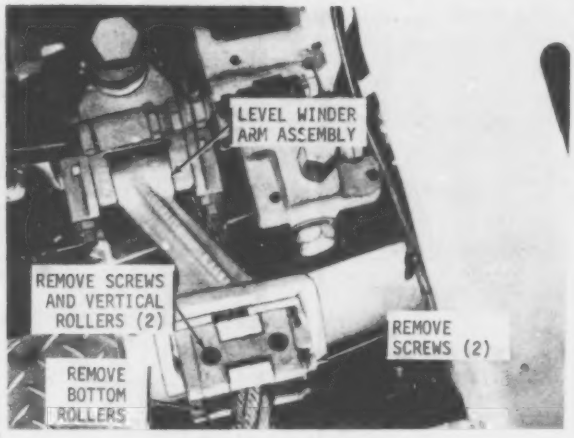
n. Storage Batteries. Refer to TM 9-2350-256-20 for removal and installation instructions for the vehicle storage batteries.

2-22. Main Winch Cable

a. Removal. Pay out cable (TM 9-2350-256-10) prior to removing it from the vehicle. Remove the cable as shown in figure 2-20.


REMOVE RETAINERS (2, 1 HIDDEN)
REMOVE SCREWS (8) LOCK WASHERS (8) (4 HIDDEN)
HALF BUSHING (2)
MOVE TOP OF GUIDE AWAY FROM CABLE
LOOSEN SCREW (HIDDEN)
REMOVE SCREWS (3) LOCK WASHERS (3)

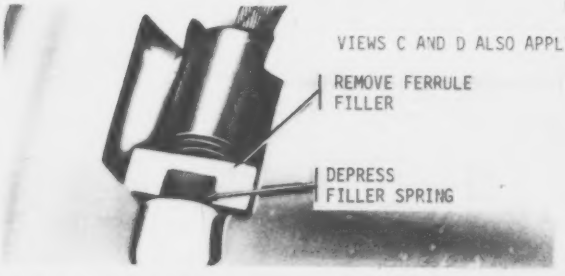
VIEW A. CLEARANCE FOR FERRULE.



VIEW B. ROLLER ASSEMBLY.

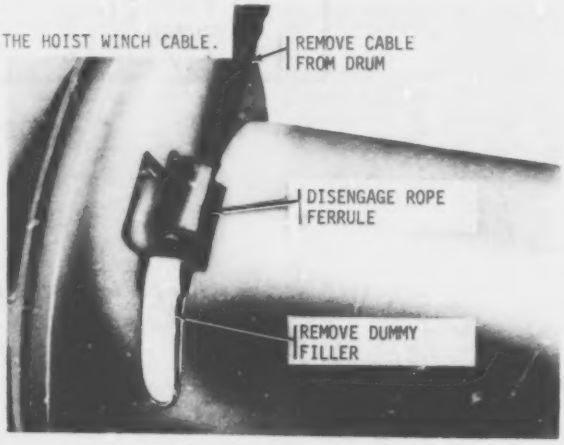
NOTE

VIEWS C AND D ALSO APPLY TO THE HOIST WINCH CABLE.



NOTE: DURING REMOVAL OF HOIST WINCH CABLE, RUN CABLE SLOWLY OUT THROUGH CAB TOP OPENING AND GUIDE CABLE OFF DRUM. PRIOR TO INSTALLATION, COAT SPRING CONTACT SURFACE OF FERRULE FILLER WITH GAA GREASE. DURING INSTALLATION, RUN WINCH SLOWLY AND GUIDE CABLE ON DRUM. APPLY LOAD TO CABLE FROM OUTSIDE OF VEHICLE TO PREVENT LOOSE CABLE WRAP ON DRUM.

VIEW C. FERRULE FILLER.



VIEW D. CABLE.

TA039256

Figure 2-20. Main winch and hoist winch cables—removal and installation.

b. Installation. Install the main winch cable in reverse order of removal. Check cable level winding on winch drum by operating winch and inspecting cable as it winds on drum. If cable does not spool evenly and fully across the drum, adjust level cylinder piston travel (TM 9-2350-256-20).

2-23. Hoist Winch Cable

a. Removal. Pay out cable (TM 9-2350-256-10) prior to removing it from vehicle. Remove the cable as shown in views C and D of figure 2-20.

b. Installation. Install hoist winch cable in reverse order of removal.

2-24. Hoisting Boom Assembly

NOTE

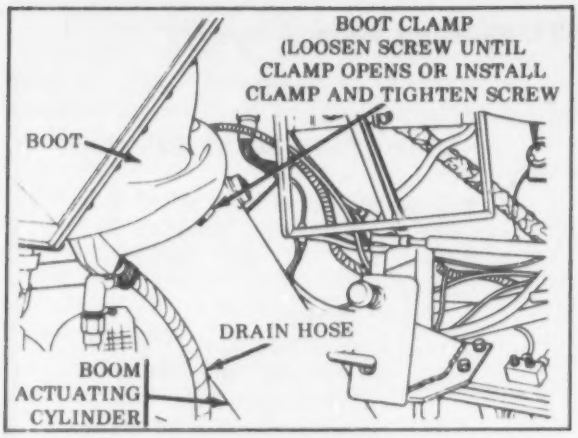
LOAD TEST REQUIREMENT

a. Load testing of hoist winch and boom is mandatory, prior to use, under any of the following conditions:
   (1) When new.
   (2) Following any repairs, disassembly and assembly, adjustments, or parts replacement, of hoist winch or boom.
   (3) When modifications are made that could affect the strength or lifting capabilities of the vehicle.

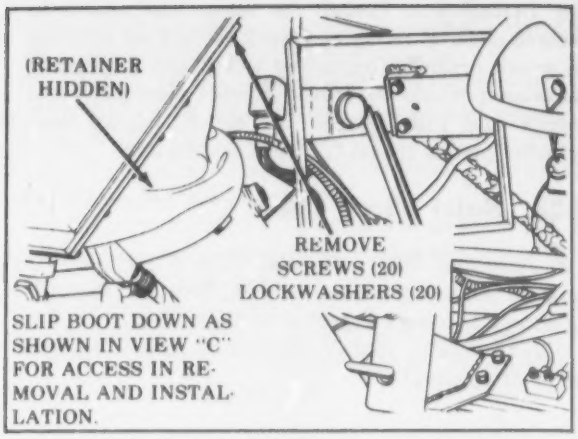
b. Load testing will be accomplished by support maintenance activities.

c. Refer to TM 9-2350-256-34-2 for detailed step-by-step procedure.

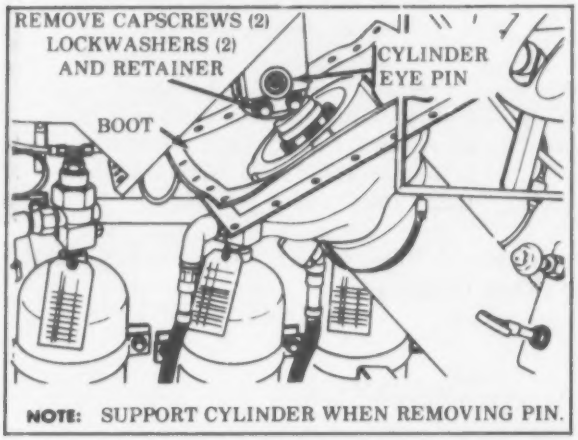
a. Removal. Remove the hoisting boom assembly as shown in figure 2-21.



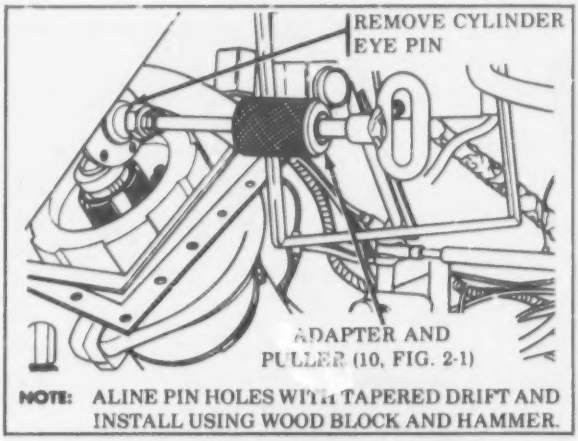
VIEW A. BOOT CLAMP AND DRAIN HOSE.



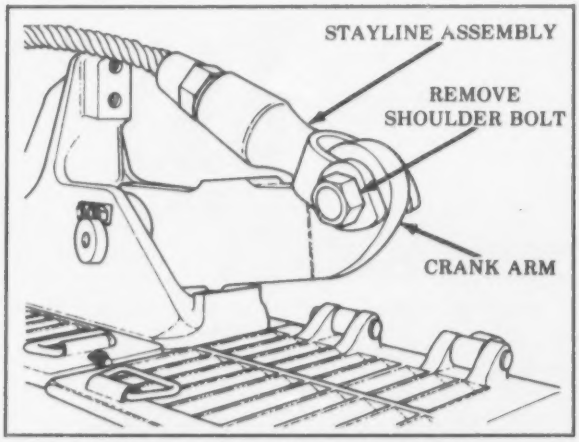
VIEW B. POSITION BOOT FOR ACCESS.



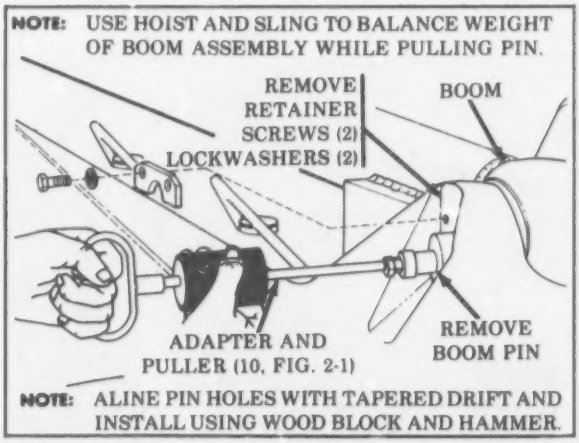
VIEW C. PIN RETAINER.


REMOVE CYLINDER
EYE PIN
ADAPTER AND
PULLER (10, FIG. 2-1)
NOTE: ALINE PIN HOLES WITH TAPERED DRIFT AND
INSTALL USING WOOD BLOCK AND HAMMER.

VIEW D. CYLINDER PIN (UPPER).



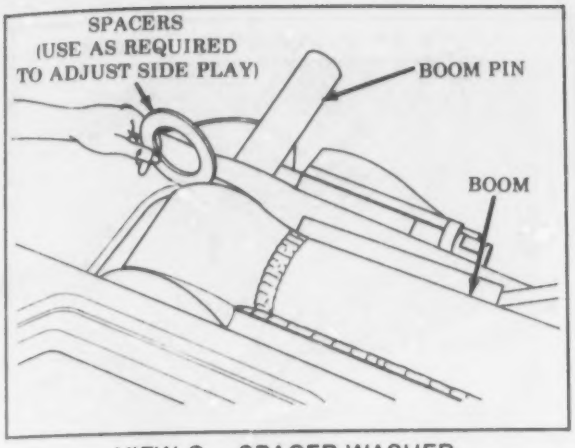
VIEW E. DISCONNECT STAYLINE.



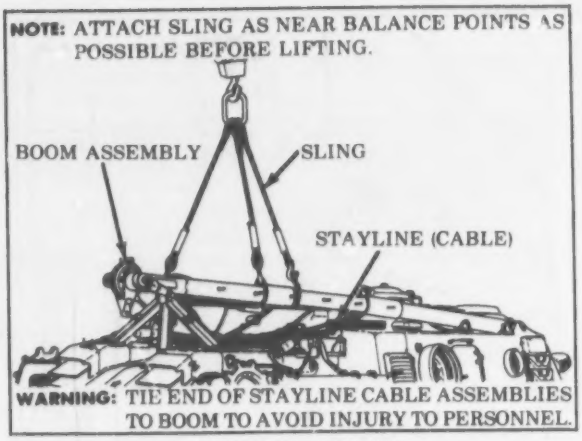
VIEW F. BOOM PIN.

Figure 2-21. Hoisting boom - removal and installation (Sheet 1 of 2).

TA171781



VIEW G. SPACER WASHER


NOTE: ATTACH SLING AS NEAR BALANCE POINTS AS POSSIBLE BEFORE LIFTING.
BOOM ASSEMBLY
SLING
STAYLINE (CABLE)
WARNING: TIE END OF STAYLINE CABLE ASSEMBLIES TO BOOM TO AVOID INJURY TO PERSONNEL.

VIEW H. BOOM

Figure 2-21. Hoisting boom - removal and installation (Sheet 2 of 2).

b. Installation. Install the hoisting boom assembly in reverse order of removal.

NOTE

If boot (fig. 2-21, views B and C) is replaced, use part number 11672351 and adhere joining strips at installation using adhesive type II, specification MMM-A-121 or MMM-A-1617.

2-24.1. Hoisting Boom Removal

WARNING

Removal of hoisting boom when both the main engine and auxiliary power unit engine are inoperable is a safety hazard and may cause injury to personnel.

a. Removal. Remove boom in accordance with figure 2-21.

(1) After powerplants are operable, start hydraulic system and exercise the boom cylinders through their entire stroke to purge all air from cylinders.

b. Installation. Install hoisting boom assembly in reverse order of removal.

2-24.2. Elevating Hoisting Boom

Deleted.

2-25. Main Winch and Spade Assembly

CAUTION

Main winch and spade assembly weights 8534 lb. Ensure lifting equipment with adequate capacity is used.

NOTE

a. Load testing of main winch is mandatory prior to use, under any of the following conditions:

(1) When new.

(2) Following any repairs, disassembly and assembly, adjustments, or parts replacement.

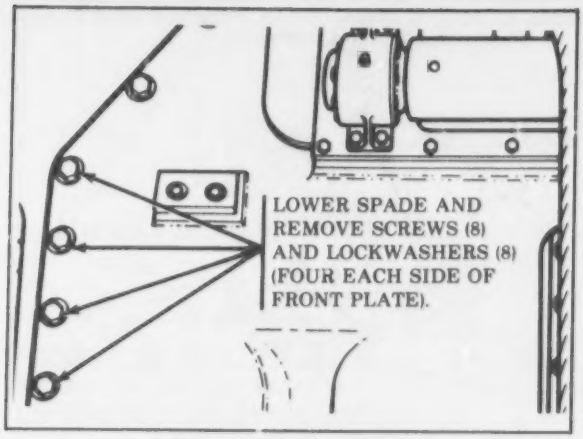
(3) When modifications are made that could affect the strength or lifting capabilities of the vehicle.

b. Load testing will be accomplished by support maintenance activities.

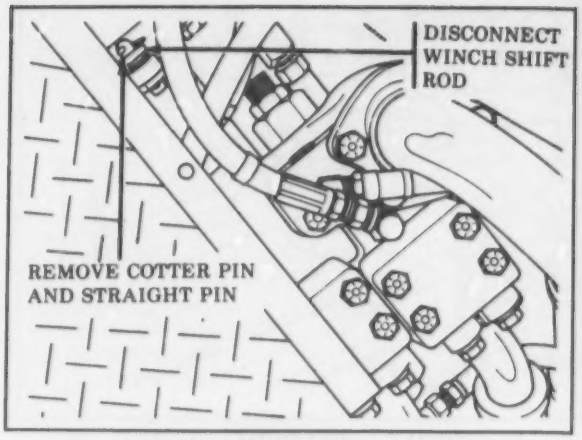
c. Refer to TM 9-2350-256-34-2 for detailed step-by-step procedure.

a. Removal. Prior to removing the main winch and spade, remove subfloor plates 2, 3, 4 (fig. 2-3) and open doors of subfloor plates 5, 21 (fig. 2-3). Remove the winch cable (para 2-22). Remove the main winch and spade assembly as shown in figure 2-22.

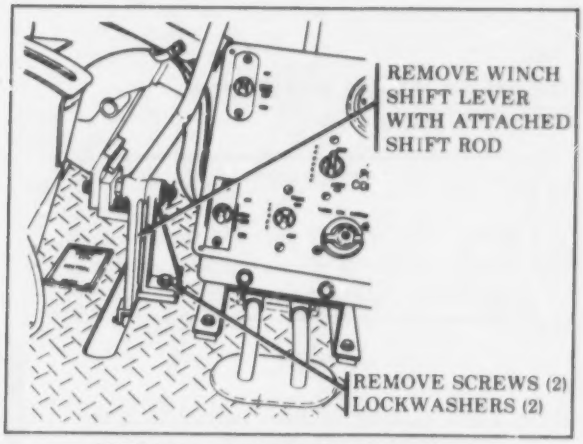
TA171782



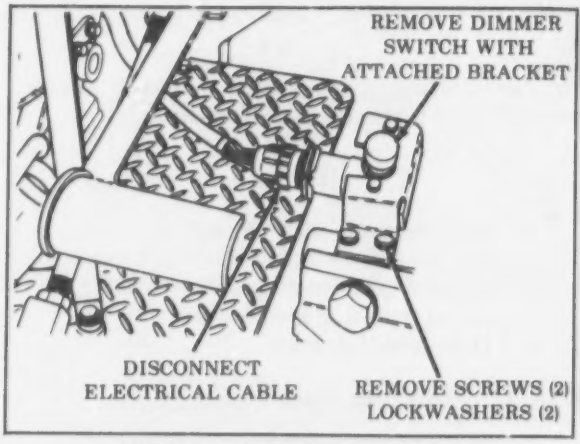
VIEW A. LOCK SPADE.



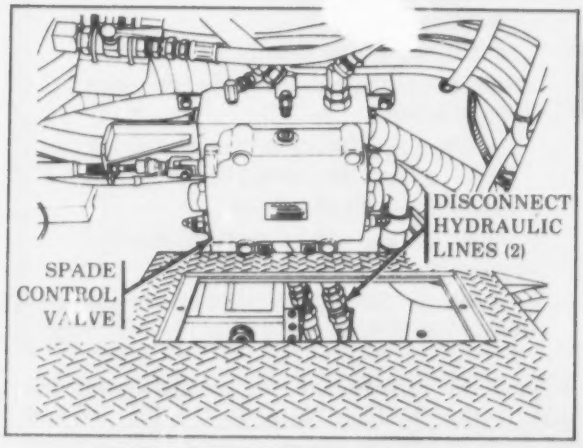
VIEW B. WINCH SHIFT ROD.



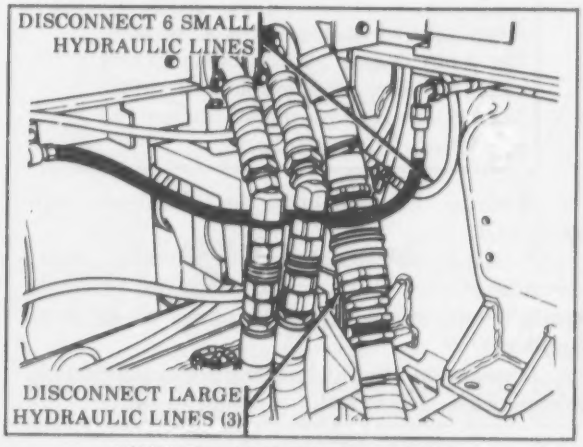
VIEW C. WINCH SHIFT LEVER.



VIEW D. DIMMER SWITCH.



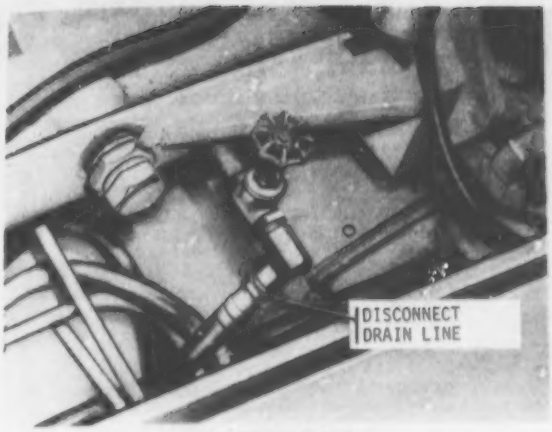
VIEW E. HYDRAULIC LINES.



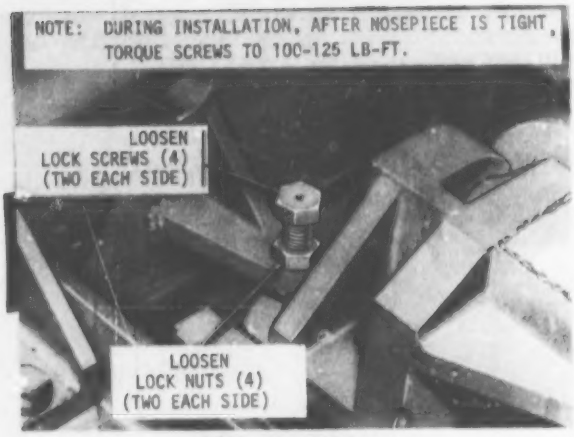
VIEW F. HYDRAULIC LINES.

Figure 2-22. Main winch and spade assembly - removal and installation (Sheet 1 of 2).

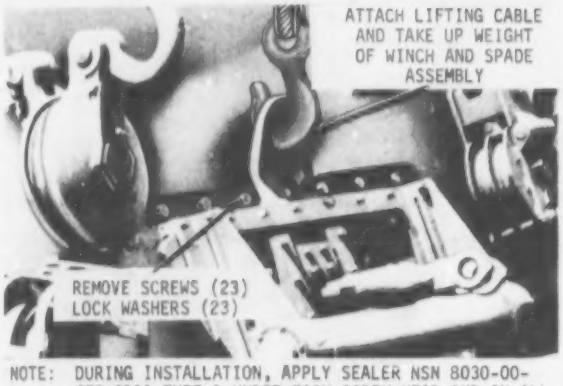
TA171783



VIEW G. DRAIN LINE.

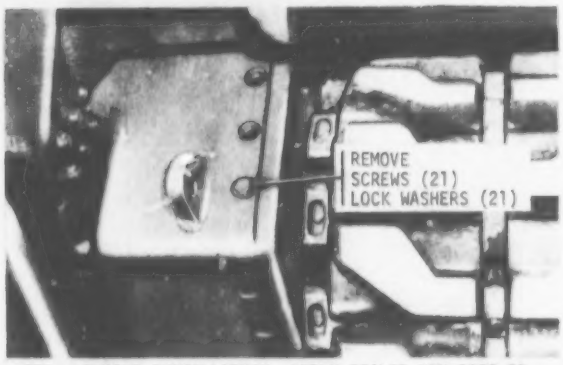


VIEW. H. SUPPORT



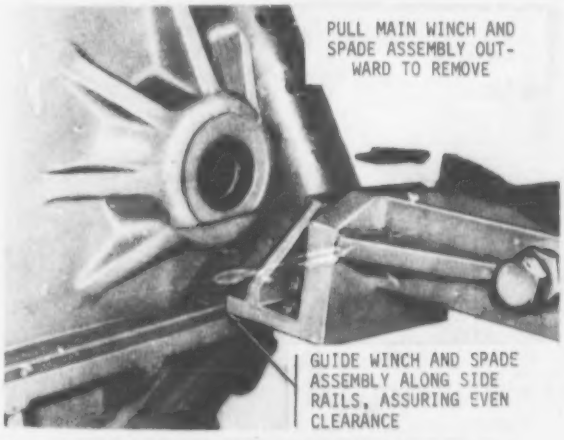
NOTE: DURING INSTALLATION, APPLY SEALER NSN 8030-00-275-8111 TYPE 1 UNDER EACH SCREW HEAD AND ON ALL THREADS. TORQUE SCREWS 300-340 LB-FT.

VIEW I. NOSEPIECE.



NOTE: DURING INSTALLATION, APPLY SEALER NSN 8030-00-275-8111 TYPE 1 UNDER EACH SCREW HEAD AND ON ALL THREADS. TORQUE SCREWS 300-340 LB-FT.

VIEW J. NOSEPIECE.


PULL MAIN WINCH AND SPADE ASSEMBLY OUTWARD TO REMOVE
GUIDE WINCH AND SPADE ASSEMBLY ALONG SIDE RAILS, ASSURING EVEN CLEARANCE

VIEW K. REMOVING WINCH AND SPADE ASSEMBLY.

VIEW L. REMOVING WINCH AND SPADE ASSEMBLY.

TA039257

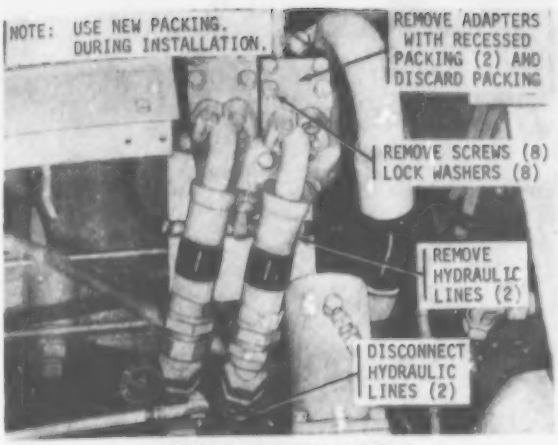
Figure 2-22. Main winch and spade assembly—removal and installation (Sheet 2 of 2).

b. Installation. Install the main winch and spade assembly in reverse order of removal, coating mating surfaces with sealant tape, 10894309. Install the winch cable (para 2-22).

2-26. **Main Winch Motor**

NOTE

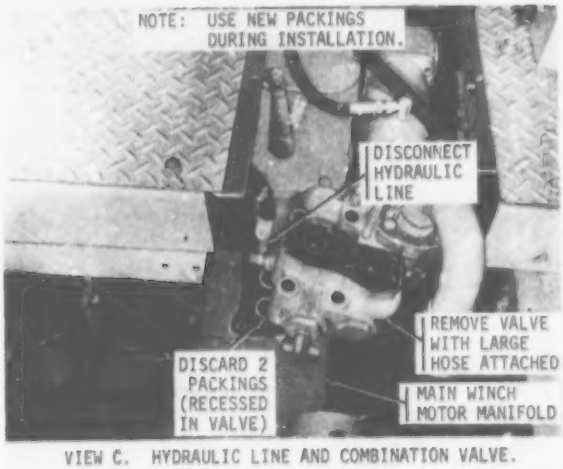
Use Hydraulic Motor Kit, 11672160 on retrofitted vehicles when replacing a motor which is not a Dennison Model No. M4E-185-3N00-B101-M40712. Remove subfloor plates 3, 4, 24 (fig. 2-3). Remove and install the main winch motor as shown in figure 2-23.


NOTE: USE NEW PACKING. DURING INSTALLATION.
REMOVE ADAPTERS WITH RECESSED PACKING (2) AND DISCARD PACKING
REMOVE SCREWS (8) LOCK WASHERS (8)
REMOVE HYDRAULIC LINES (2)
DISCONNECT HYDRAULIC LINES (2)

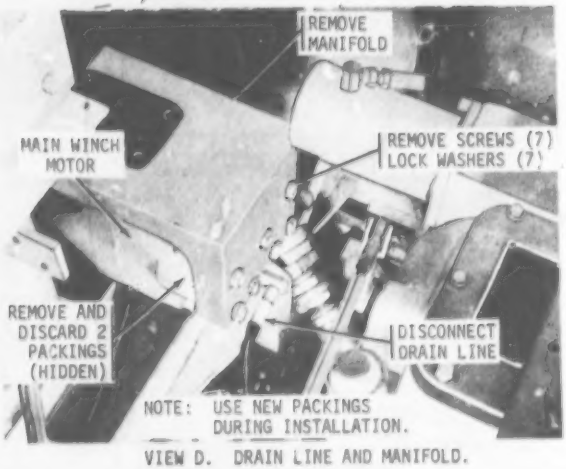
VIEW A. HYDRAULIC LINES.

REMOVE SCREWS (4) TORQUE TO 45 LB-FT DURING INSTALLATION (APPEIES ONLY TO VALVE MFD BY N.Y. AIR BRAKE CO.)
DISCONNECT HYDRAULIC LINES (3)
DISCONNECT HYDRAULIC LINES
DISCONNECT HYDRAULIC LINE

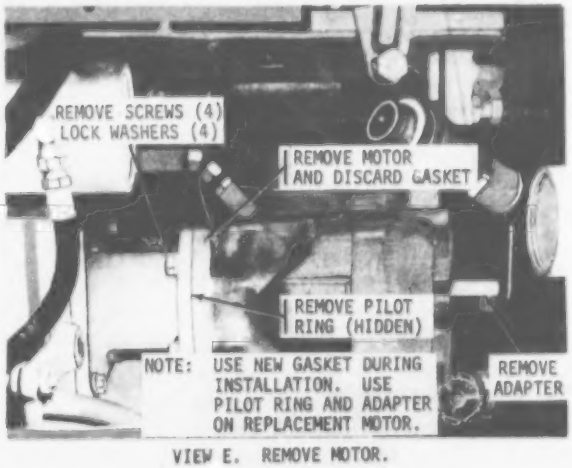
VIEW B. HYDRAULIC LINES.


NOTE: USE NEW PACKINGS DURING INSTALLATION.
DISCONNECT HYDRAULIC LINE
REMOVE VALVE WITH LARGE HOSE ATTACHED
DISCARD 2 PACKINGS (RECESSED IN VALVE)
MAIN WINCH MOTOR MANIFOLD

VIEW C. HYDRAULIC LINE AND COMBINATION VALVE.


REMOVE MANIFOLD
MAIN WINCH MOTOR
REMOVE SCREWS (7) LOCK WASHERS (7)
REMOVE AND DISCARD 2 PACKINGS (HIDDEN)
DISCONNECT DRAIN LINE
NOTE: USE NEW PACKINGS DURING INSTALLATION.

VIEW D. DRAIN LINE AND MANIFOLD.


REMOVE SCREWS (4) LOCK WASHERS (4)
REMOVE MOTOR AND DISCARD GASKET
REMOVE PILOT RING (HIDDEN)
NOTE: USE NEW GASKET DURING INSTALLATION. USE PILOT RING AND ADAPTER ON REPLACEMENT MOTOR.
REMOVE ADAPTER

VIEW E. REMOVE MOTOR.

TA016171

Figure 2-23. Main winch motor—removal and installation.

2-27. Main Winch Level Winder Arm Assembly

Remove and install the level winder arm assembly as shown in figure 2-24.

2-28. Spade Lock Control

The spade lock control components are accessible without removing the main winch and spade. Refer to TM 9-2350-256-20 for removal, repair and installation instructions.

2-29. Boom and Stayline Actuating Cylinder Assemblies and Stayline Actuating Cylinder Crank Arms

a. Boom Stayline Actuating Cylinders.

(1) *Removal.* Prior to removing the boom stayline actuating cylinders, raise boom (TM 9-2350-256-10) so that cylinder pistons are retracted and remove engine deck (TM 9-2350-256-20). Remove access plates 9, 17 (fig. 2-2). Remove boom stayline actuating cylinders as shown in figure 2-25.

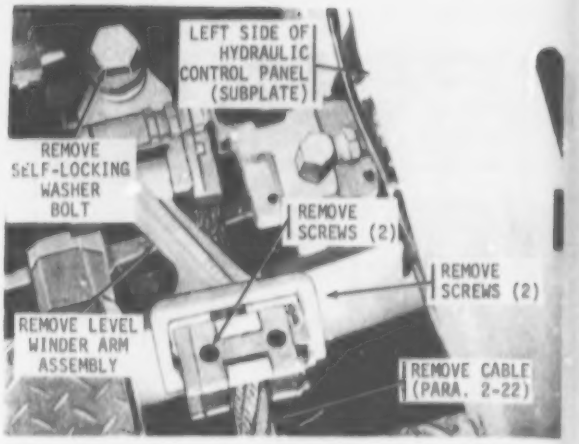


Figure 2-24. Main winch cable and level winder arm assembly—removal and installation.

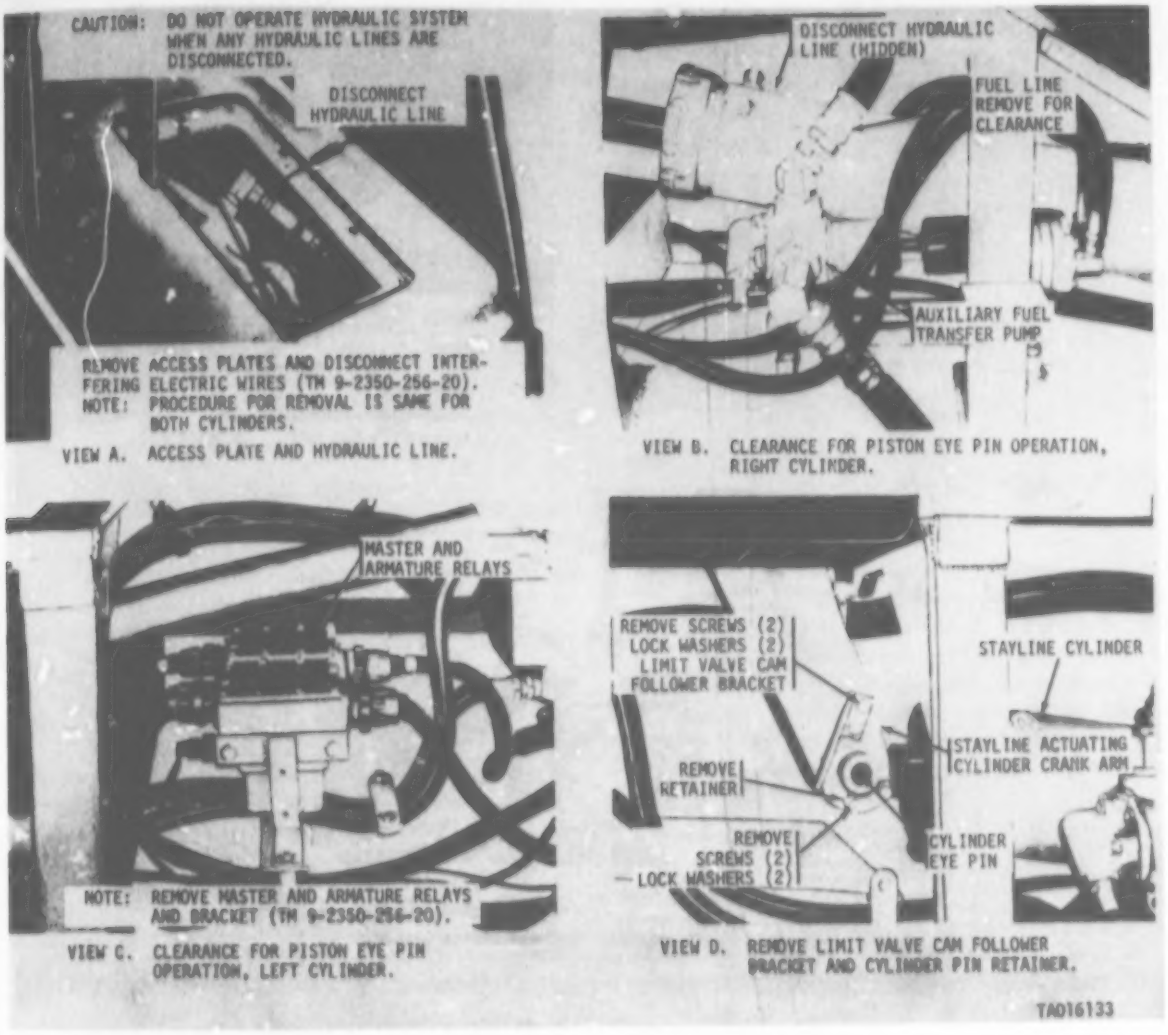

CAUTION: DO NOT OPERATE HYDRAULIC SYSTEM WHEN ANY HYDRAULIC LINES ARE DISCONNECTED.
DISCONNECT HYDRAULIC LINE
REMOVE ACCESS PLATES AND DISCONNECT INTERFERING ELECTRIC WIRES (TM 9-2350-256-20).
NOTE: PROCEDURE FOR REMOVAL IS SAME FOR BOTH CYLINDERS.
VIEW A. ACCESS PLATE AND HYDRAULIC LINE.
DISCONNECT HYDRAULIC LINE (HIDDEN)
FUEL LINE REMOVE FOR CLEARANCE
AUXILIARY FUEL TRANSFER PUMP
VIEW B. CLEARANCE FOR PISTON EYE PIN OPERATION, RIGHT CYLINDER.
MASTER AND ARMATURE RELAYS
NOTE: REMOVE MASTER AND ARMATURE RELAYS AND BRACKET (TM 9-2350-256-20).
VIEW C. CLEARANCE FOR PISTON EYE PIN OPERATION, LEFT CYLINDER.
REMOVE SCREWS (2)
LOCK WASHERS (2)
LIMIT VALVE CAM FOLLOWER BRACKET
STAYLINE CYLINDER
STAYLINE ACTUATING CYLINDER CRANK ARM
REMOVE RETAINER
REMOVE SCREWS (2)
LOCK WASHERS (2)
CYLINDER EYE PIN
VIEW D. REMOVE LIMIT VALVE CAM FOLLOWER BRACKET AND CYLINDER PIN RETAINER.
TA016133

Figure 2-25. Boom stayline actuating cylinders—removal and installation (Sheet 1 of 2).

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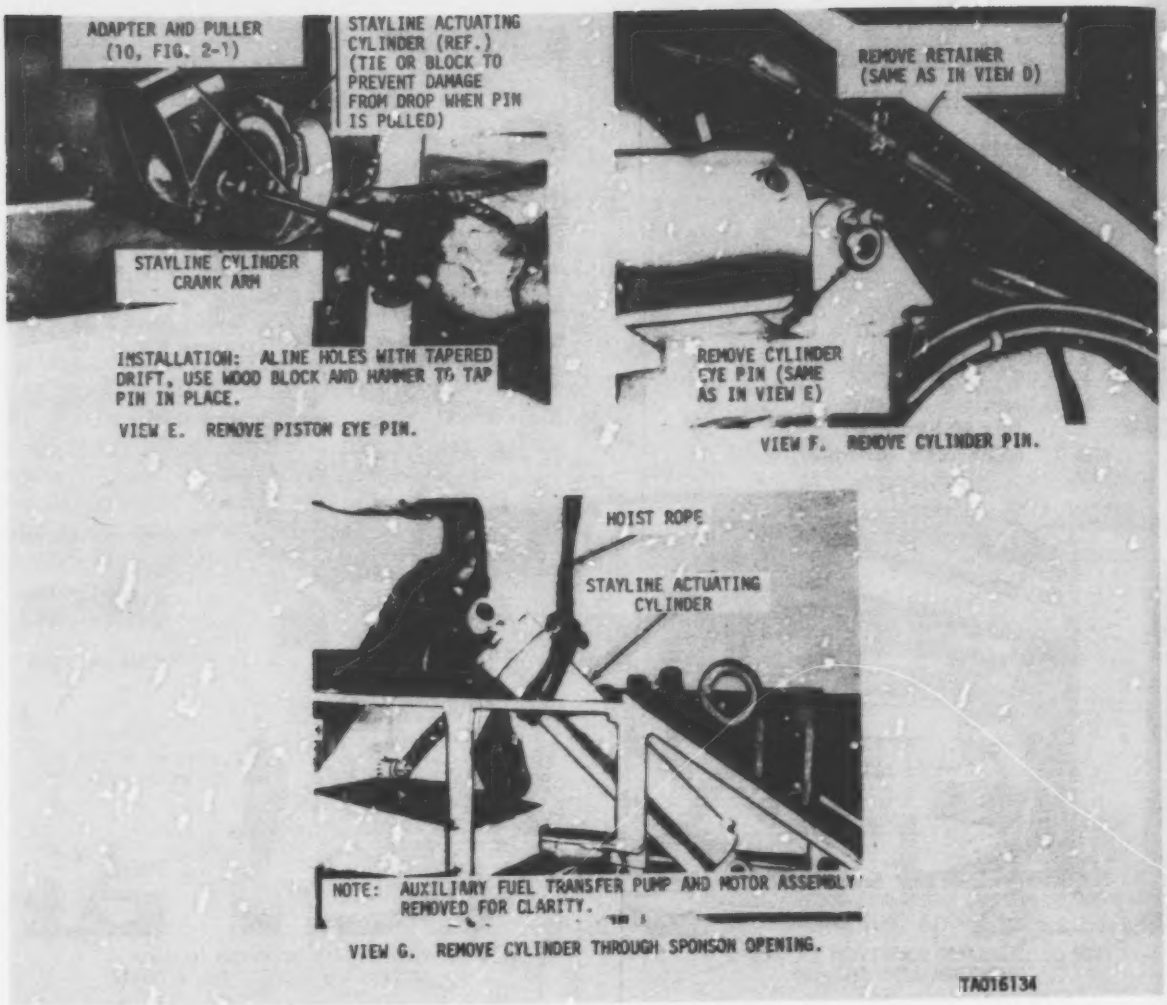

ADAPTER AND PULLER (10, FIG. 2-1)
STAYLINE ACTUATING CYLINDER (REF.) (TIE OR BLOCK TO PREVENT DAMAGE FROM DROP WHEN PIN IS PULLED)
STAYLINE CYLINDER CRANK ARM
INSTALLATION: ALINE HOLES WITH TAPERED DRIFT, USE WOOD BLOCK AND HAMMER TO TAP PIN IN PLACE.
VIEW E. REMOVE PISTON EYE PIN.
REMOVE RETAINER (SAME AS IN VIEW D)
REMOVE CYLINDER EYE PIN (SAME AS IN VIEW E)
VIEW F. REMOVE CYLINDER PIN.
HOIST ROPE
STAYLINE ACTUATING CYLINDER
NOTE: AUXILIARY FUEL TRANSFER PUMP AND MOTOR ASSEMBLY REMOVED FOR CLARITY.
VIEW G. REMOVE CYLINDER THROUGH SPONSON OPENING.
TA016134

Figure 2-25. Boom stayline actuating cylinders—removal and installation (Sheet 2 of 2).

(2) *Installation.* Install boom stayline actuating cylinders in reverse order of removal.

b. Boom Actuating Cylinders.

(1) *Removal.*

(*a*) Procedure for removal and installation of the boom actuating cylinders is the same as for the stayline actuating cylinders except for their location on the vehicle. Prior to removal of the boom actuating cylinders, remove driver's and mechanic's seats for working clearance (TM 9-2350-256-20).

NOTE

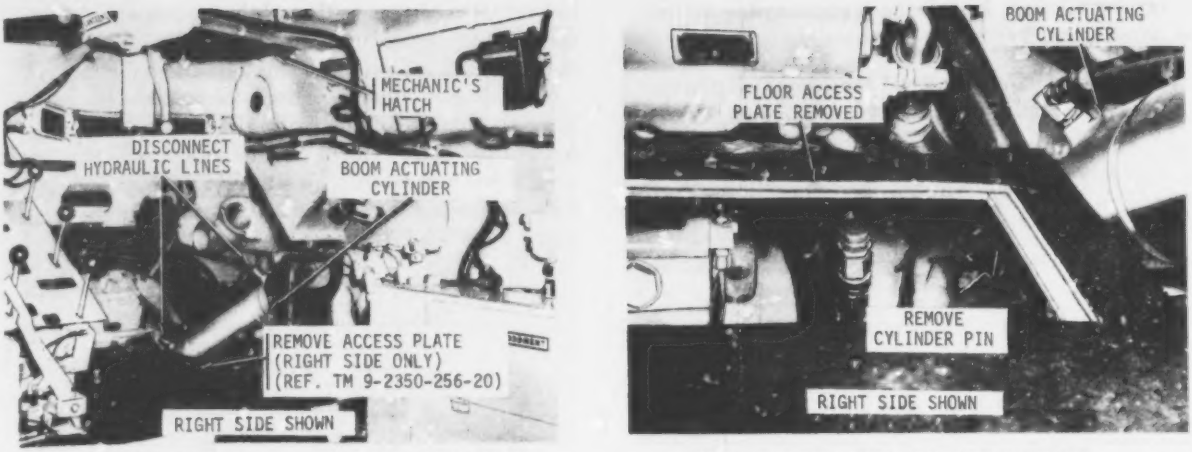
Hoist cylinders through driver's and mechanic's hatches.

(*b*) Remove boom actuating cylinder piston eye pins as shown in figure 2-21, and remove boots from cylinders.

(*c*) Introduce hoist rope or chain through mechanic's or driver's hatch and support weight of cylinder while removing cylinder pin.

(*d*) Remove cylinder pins in same manner as piston eye pins (refer to figure 2-21) and disconnect hydraulic lines. Refer to figure 2-26 for access to right side.

(*e*) While guiding by hand, hoist cylinder out driver's or mechanic's hatch.



VIEW A. HYDRAULIC LINES AND SUBFLOOR ACCESS PLATE.

VIEW B. REMOVE BOOM ACTUATING CYLINDER.

TA016135

Figure 2-26 Boom actuating cylinders—Removal and installation access to right side.

(2) *Installation.* Reverse removal procedure but start hydraulic system and exercise boom cylinders through their entire stroke to purge all air from cylinders prior to installing piston eye pins.

c. Boom Stayline Actuating Cylinder Crank Arms.

(1) *Removal.* Prior to removal of the boom stayline actuating cylinder crank arms, remove engine deck assembly (TM 9-2350-256-20). Place suitable wood block in front of air intake covers and lower boom onto blocks. Remove boom staylines (View E, fig. 2-21) and boom stayline actuating cylinders (fig. 2-25). In View A of figure 2-25, install a hose on hydraulic line connections for draining fluid into suitable container. Prior to View D, place crank arms in the up position. Proceed with Views D and E on figure 2-25. Remove boom stayline actuating cylinder crank arms as shown in figure 2-27.

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(2) *Installation.* Install the boom stayline actuating cylinder crank arms in reverse order of removal.

2-30. Hydraulic Control Panel (Subplate) Assembly and Control Valves

a. General. The seven control valves comprising part of the main hydraulic subplate assembly can be removed and replaced individually if defective. Refer to TM 9-2350-256-34-2 for description and operation of these valves. Removal and installation of these individual valves, as well as of the main hydraulic subplate assembly as a unit, are described and illustrated in the following sections of this paragraph.

b. Hydraulic Control Panel (Subplate) Assembly. Prior to removal of the hydraulic subplate assembly, remove the shift control (TM 9-2350-256-20), APU control box and mechanic's seat (TM 9-2350-256-20). Remove the hydraulic subplate assembly as shown in figure 2-28.

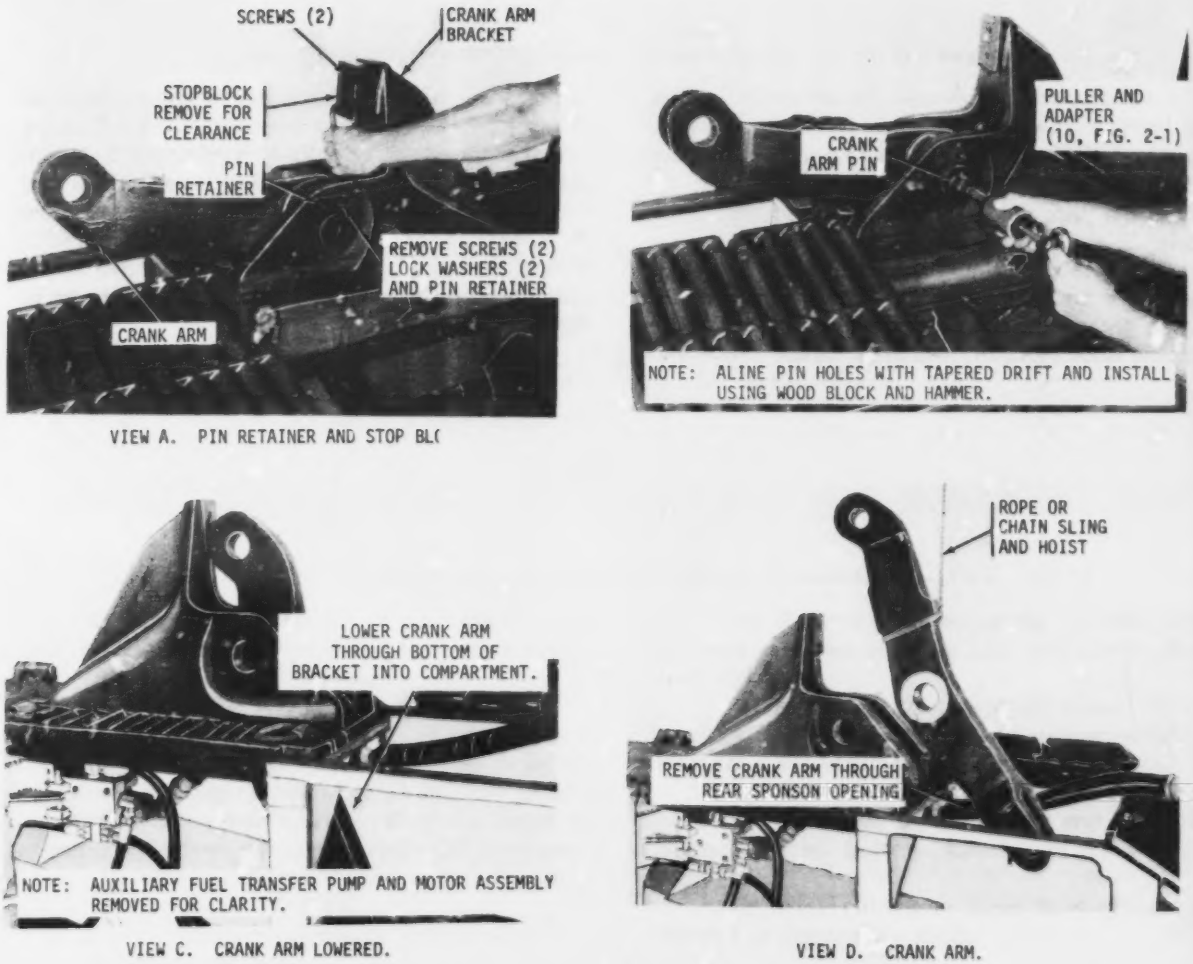
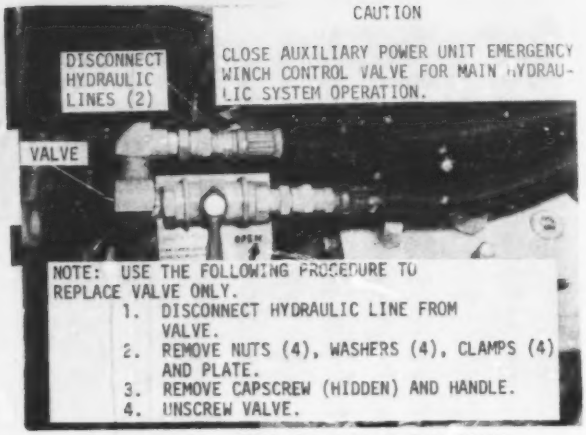

SCREWS (2)
CRANK ARM BRACKET
STOPBLOCK REMOVE FOR CLEARANCE
PIN RETAINER
REMOVE SCREWS (2) LOCK WASHERS (2) AND PIN RETAINER
CRANK ARM
VIEW A. PIN RETAINER AND STOP BL(
CRANK ARM PIN
PULLER AND ADAPTER (10, FIG. 2-1)
NOTE: ALINE PIN HOLES WITH TAPERED DRIFT AND INSTALL USING WOOD BLOCK AND HAMMER.
LOWER CRANK ARM THROUGH BOTTOM OF BRACKET INTO COMPARTMENT.
NOTE: AUXILIARY FUEL TRANSFER PUMP AND MOTOR ASSEMBLY REMOVED FOR CLARITY.
VIEW C. CRANK ARM LOWERED.
ROPE OR CHAIN SLING AND HOIST
REMOVE CRANK ARM THROUGH REAR SPONSON OPENING
VIEW D. CRANK ARM.
NOTE: OPERATIONS SAME FOR LEFT AND RIGHT SIDES OF VEHICLE.
TA016151

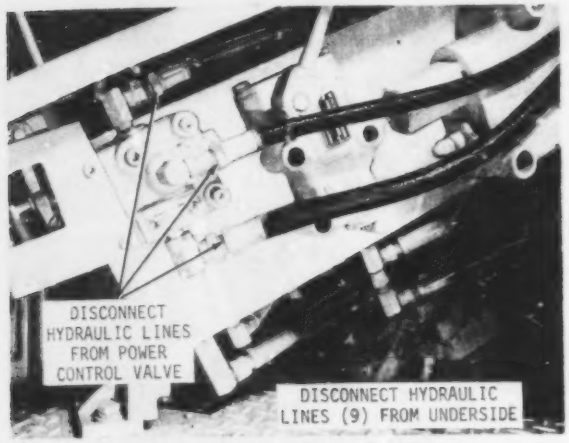
Figure 2-27. Boom stayline actuating cylinder crank arms—removal and installation.

REMOVE KNOBS (6)
REMOVE CLAMPS (3) AND WIRING HARNESS
DISCONNECT ELECTRICAL CONNECTORS (2)
REMOVE DRAIN VALVE CONTROL
REMOVE COTTER PINS (2), PINS (2) DISCONNECT LINKAGE
REMOVE SCREWS (2) LOCK WASHERS (2)

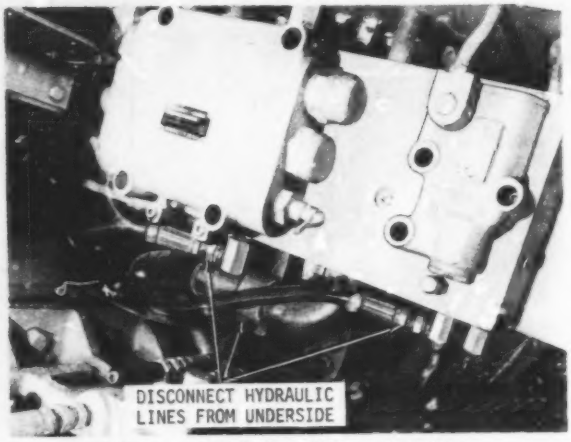
VIEW A. KNOBS AND INTERFERING COMPONENTS.


CAUTION
CLOSE AUXILIARY POWER UNIT EMERGENCY WINCH CONTROL VALVE FOR MAIN HYDRAULIC SYSTEM OPERATION.
DISCONNECT HYDRAULIC LINES (2)
VALVE
NOTE: USE THE FOLLOWING PROCEDURE TO REPLACE VALVE ONLY.
1. DISCONNECT HYDRAULIC LINE FROM VALVE.
2. REMOVE NUTS (4), WASHERS (4), CLAMPS (4) AND PLATE.
3. REMOVE CAPSCREW (HIDDEN) AND HANDLE.
4. UNSCREW VALVE.

VIEW B. APU EMERGENCY WINCH CONTROL VALVE.



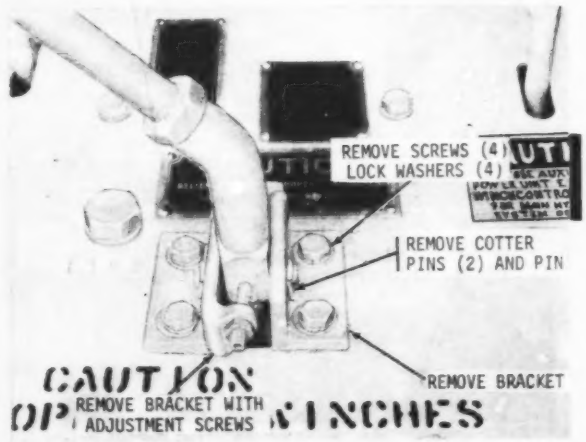
VIEW C. HYDRAULIC LINES - RIGHT SIDE.



VIEW D. HYDRAULIC LINES - LEFT SIDE.

NOTE: USE NEW PACKINGS DURING INSTALLATION
REMOVE SCREWS (8) LOCK WASHERS (8)
DISCONNECT FLANGE TYPE HOSES REMOVE AND DISCARD PACKINGS (2)

VIEW E. HYDRAULIC LINES - RIGHT SIDE.

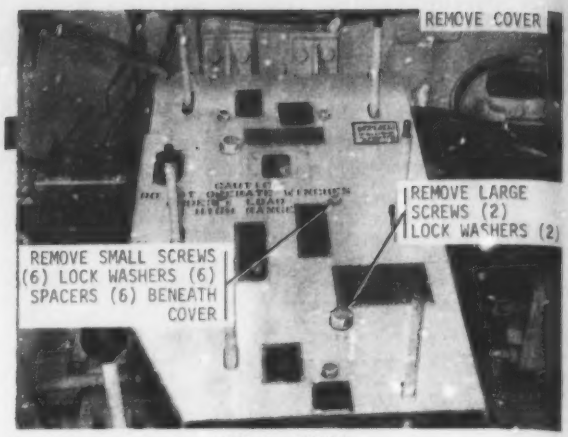

REMOVE SCREWS (4) LOCK WASHERS (4)
REMOVE COTTER PINS (2) AND PIN
REMOVE BRACKET
CAUTION
REMOVE BRACKET WITH ADJUSTMENT SCREWS

VIEW F. SPADE CONTROL LEVER BRACKETS.

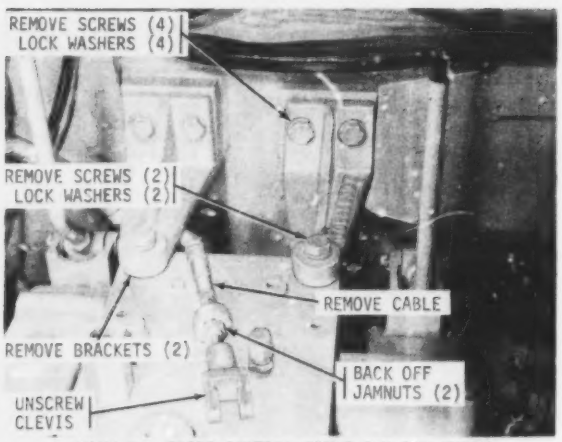
TA039259

Figure 2-28. Hydraulic control panel (subplate) assembly—removal and installation (Sheet 1 of 3).

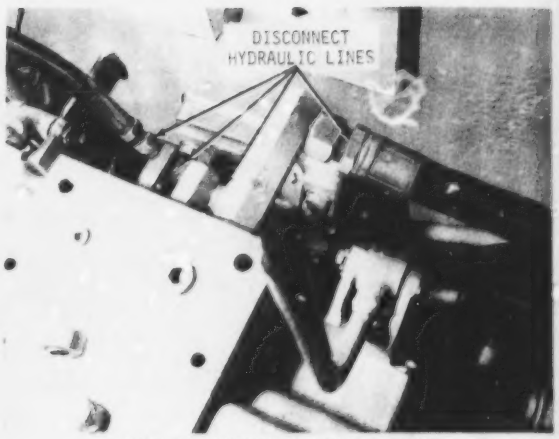
VIEW G. SPADE CONTROL LEVER.



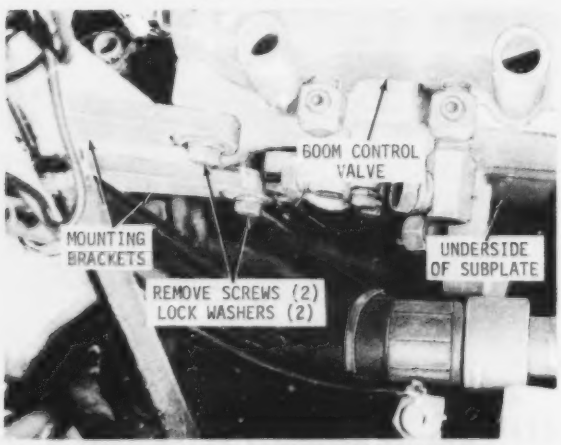
VIEW H. COVER.



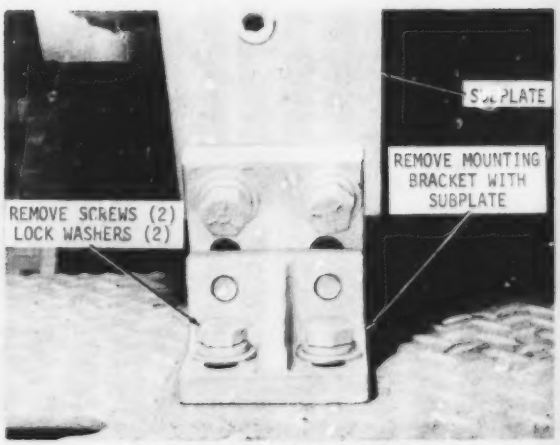
VIEW I. SPADE CONTROL CABLE AND TOP FRONT MOUNTING BRACKETS.



VIEW J. HYDRAULIC LINES - FRONT.



VIEW K. BOTTOM FRONT MOUNTING SCREWS.



VIEW L. REAR MOUNTING SCREWS.

TA039260

Figure 2-28. Hydraulic control panel (subplate) assembly—removal and installation (Sheet 2 of 3).

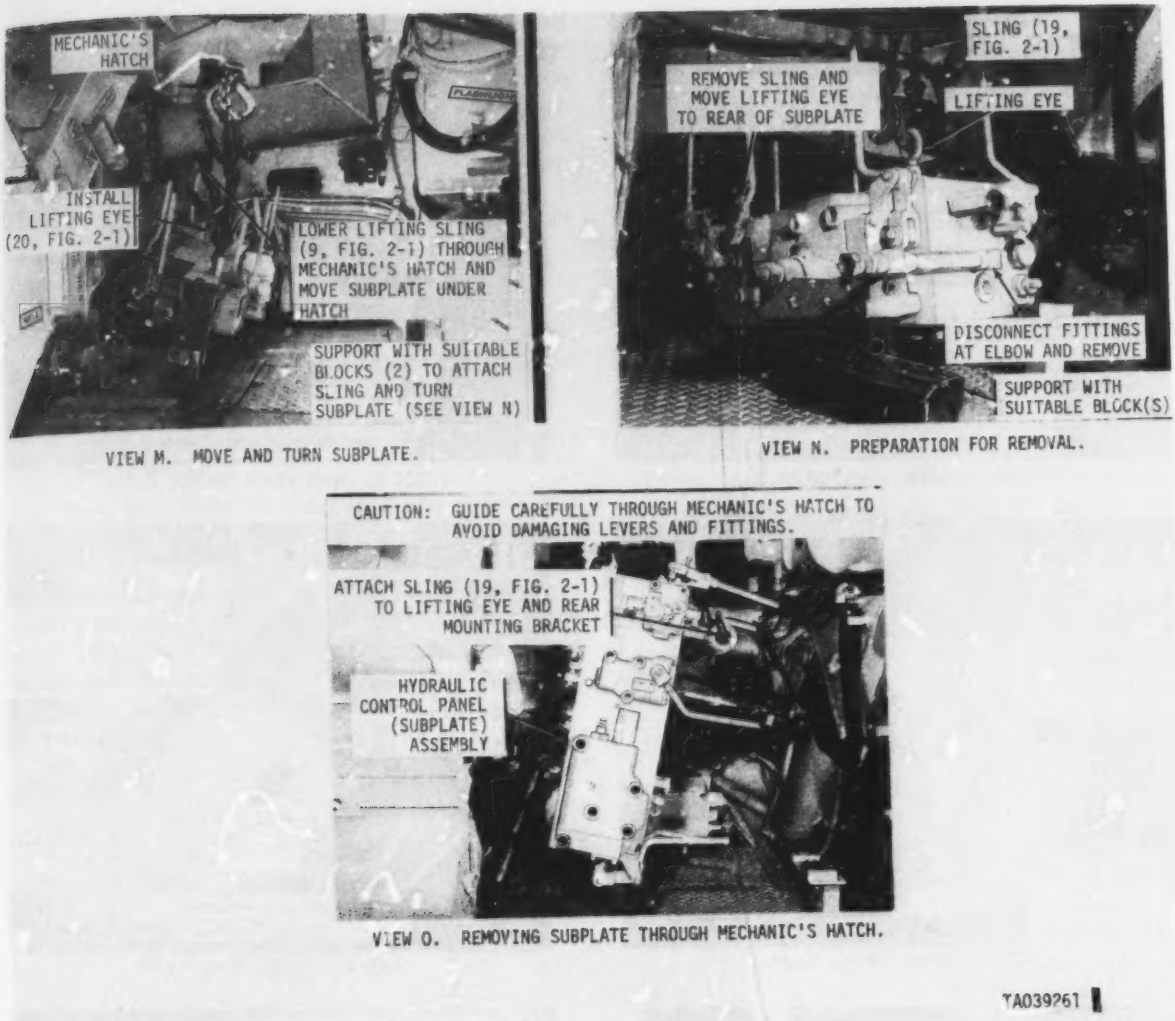

MECHANIC'S HATCH
INSTALL LIFTING EYE (20, FIG. 2-1)
LOWER LIFTING SLING (9, FIG. 2-1) THROUGH MECHANIC'S HATCH AND MOVE SUBPLATE UNDER HATCH
SUPPORT WITH SUITABLE BLOCKS (2) TO ATTACH SLING AND TURN SUBPLATE (SEE VIEW N)
VIEW M. MOVE AND TURN SUBPLATE.
SLING (19, FIG. 2-1)
REMOVE SLING AND MOVE LIFTING EYE TO REAR OF SUBPLATE
LIFTING EYE
DISCONNECT FITTINGS AT ELBOW AND REMOVE
SUPPORT WITH SUITABLE BLOCK(S)
VIEW N. PREPARATION FOR REMOVAL.
CAUTION: GUIDE CAREFULLY THROUGH MECHANIC'S HATCH TO AVOID DAMAGING LEVERS AND FITTINGS.
ATTACH SLING (19, FIG. 2-1) TO LIFTING EYE AND REAR MOUNTING BRACKET
HYDRAULIC CONTROL PANEL (SUBPLATE) ASSEMBLY
VIEW O. REMOVING SUBPLATE THROUGH MECHANIC'S HATCH.
TA039261

Figure 2-28. Hydraulic control panel (Subplate) assembly—removal and installation (Sheet 3 of 3).

c. Auxiliary Power Unit Emergency Winch Control Valve. Remove and install the auxiliary power unit emergency winch control valve as shown in View B, figure 2-28.

CAUTION

Close auxiliary power unit emergency winch control valve for main hydraulic system operation.

d. System Selector Valve. Remove and install the system selector valve as shown in figure 2-29.

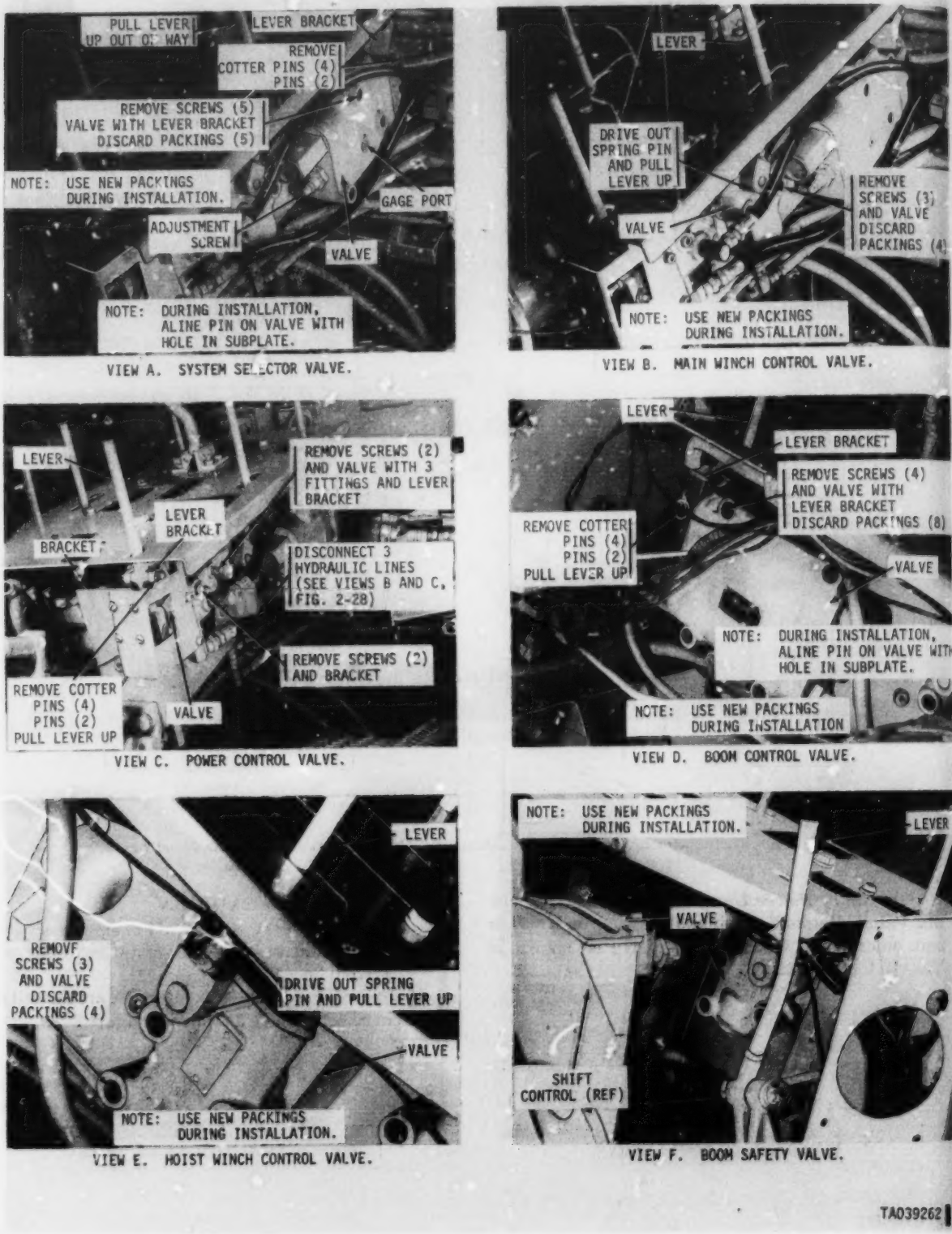

PULL LEVER UP OUT OF WAY
LEVER BRACKET
REMOVE COTTER PINS (4) PINS (2)
REMOVE SCREWS (5) VALVE WITH LEVER BRACKET DISCARD PACKINGS (5)
NOTE: USE NEW PACKINGS DURING INSTALLATION.
GAGE PORT
ADJUSTMENT SCREW
VALVE
NOTE: DURING INSTALLATION, ALINE PIN ON VALVE WITH HOLE IN SUBPLATE.
VIEW A. SYSTEM SELECTOR VALVE.
LEVER
DRIVE OUT SPRING PIN AND PULL LEVER UP
REMOVE SCREWS (3) AND VALVE DISCARD PACKINGS (4)
VALVE
NOTE: USE NEW PACKINGS DURING INSTALLATION.
VIEW B. MAIN WINCH CONTROL VALVE.
LEVER
LEVER BRACKET
REMOVE SCREWS (2) AND VALVE WITH 3 FITTINGS AND LEVER BRACKET
BRACKET
DISCONNECT 3 HYDRAULIC LINES (SEE VIEWS B AND C, FIG. 2-28)
REMOVE SCREWS (2) AND BRACKET
REMOVE COTTER PINS (4) PINS (2) PULL LEVER UP
VALVE
VIEW C. POWER CONTROL VALVE.
LEVER
LEVER BRACKET
REMOVE SCREWS (4) AND VALVE WITH LEVER BRACKET DISCARD PACKINGS (8)
REMOVE COTTER PINS (4) PINS (2) PULL LEVER UP
VALVE
NOTE: DURING INSTALLATION, ALINE PIN ON VALVE WITH HOLE IN SUBPLATE.
NOTE: USE NEW PACKINGS DURING INSTALLATION
VIEW D. BOOM CONTROL VALVE.
LEVER
REMOVE SCREWS (3) AND VALVE DISCARD PACKINGS (4)
DRIVE OUT SPRING PIN AND PULL LEVER UP
VALVE
NOTE: USE NEW PACKINGS DURING INSTALLATION.
VIEW E. HOIST WINCH CONTROL VALVE.
NOTE: USE NEW PACKINGS DURING INSTALLATION.
LEVER
VALVE
SHIFT CONTROL (REF)
VIEW F. BOOM SAFETY VALVE.
TA039262

Figure 2-29. Hydraulic valves on control panel (subplate) assembly—removal and installation.

e. Main Winch Control Valve. Remove and install the main winch control valve as shown in figure 2-29.

f. Power Control Valve. Remove and install the power control valve as shown in figure 2-29.

g. Boom Combination Control Valve. Remove and install the boom combination control valve as shown in figure 2-29.

h. Hoist Winch Control Valve. Prior to removal of the hoist winch control valve, remove the shift control (TM 9-2350-256-20). Remove and install the hoist winch control valve as shown in figure 2-29.

i. Boom Safety Control Valve. Remove and install the boom safety control valve as shown in figure 2-29.

2-31. Mechanical Transmission Power Takeoff Drive Shaft

a. Removal. Prior to removing the mechanical transmission power takeoff (PTO) drive shaft, remove deck grilles 27, 28, and 29 (fig. 2-2) and subfloor plate 12 (fig. 2-3). Disconnect interfering lines and cables as necessary for access and remove the mechanical transmission PTO drive shaft as shown in figure 2-30.

NOTE

IF NECESSARY TO TURN PROPELLER SHAFT TO REACH SCREWS, TURN MASTER SWITCH TO ON POSITION. HOLD FUEL SHUTOFF SWITCH IN OFF POSITION AND TOUCH STARTER SWITCH. WHEN SCREWS ARE IN POSITION FOR REMOVAL, TURN MASTER SWITCH TO OFF POSITION.

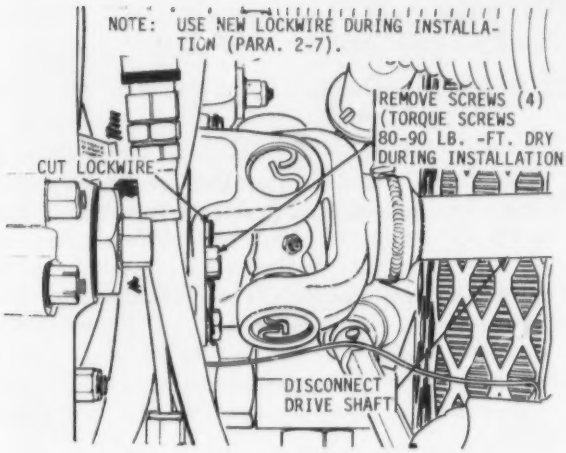
b. Installation. Install the mechanical transmission PTO drive shaft in reverse order of removal.

2-32. Mechanical Transmission and Main Hydraulic Pump Assembly

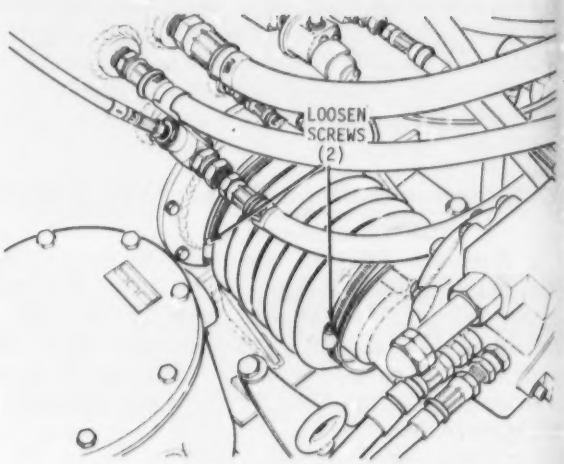
a. Removal. Prior to removing the mechanical transmission and main hydraulic pump assembly, remove the following components from the vehicle (TM 9-2350-256-20): cupola and cupola plate assembly, oddment trays, boxes, racks or baskets, as required for clearance and to prevent damage, commander's seat, passenger seats, and subfloor plates 11, 12 (with rigger's seat attached), 13, 14, 17, and 18 (fig. 2-3). Remove the mechanical transmission and main hydraulic pump assembly as shown in figure 2-31.

NOTE

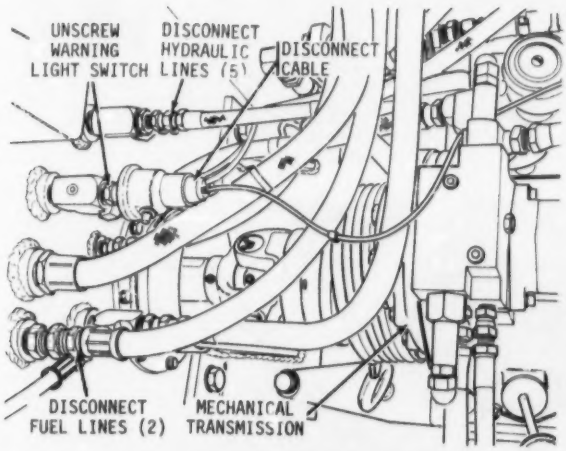
IF NECESSARY TO TURN PROPELLER SHAFT TO REACH SCREWS, TURN MASTER SWITCH TO ON POSITION. HOLD FUEL SHUTOFF SWITCH IN OFF POSITION AND TOUCH STARTER SWITCH. WHEN SCREWS ARE IN POSITION FOR REMOVAL. TURN MASTER SWITCH TO OFF POSITION.


NOTE: USE NEW LOCKWIRE DURING INSTALLATION (PARA. 2-7).
REMOVE SCREWS (4) (TORQUE SCREWS 80-90 LB. -FT. DRY DURING INSTALLATION
CUT LOCKWIRE
DISCONNECT DRIVE SHAFT

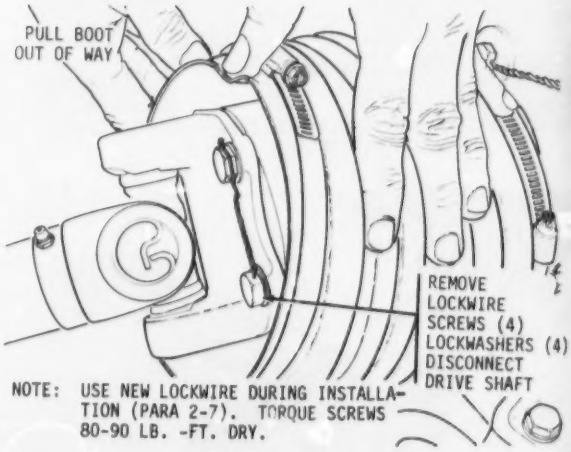
VIEW A. DRIVE SHAFT FROM MAIN ENGINE.



VIEW B. UNIVERSAL BOOT.



VIEW C. BULKHEAD CONNECTIONS FOR ACCESS.


PULL BOOT OUT OF WAY
REMOVE LOCKWIRE SCREWS (4) LOCKWASHERS (4) DISCONNECT DRIVE SHAFT
NOTE: USE NEW LOCKWIRE DURING INSTALLATION (PARA 2-7). TORQUE SCREWS 80-90 LB. -FT. DRY.

VIEW D. DRIVE SHAFT FROM TRANSMISSION.

TA171402

Figure 2-30. Mechanical transmission power takeoff drive shaft—removal and installation.

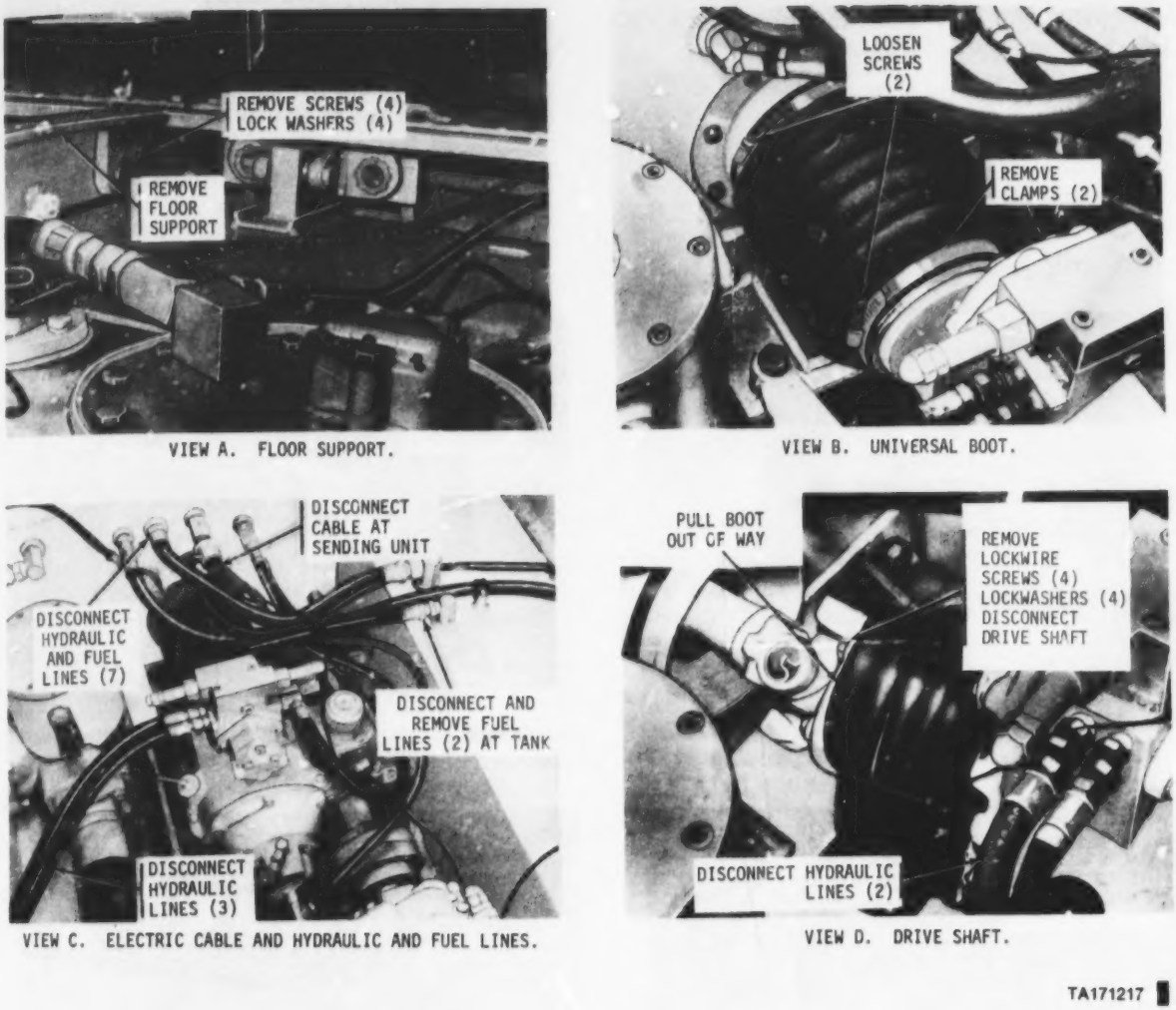
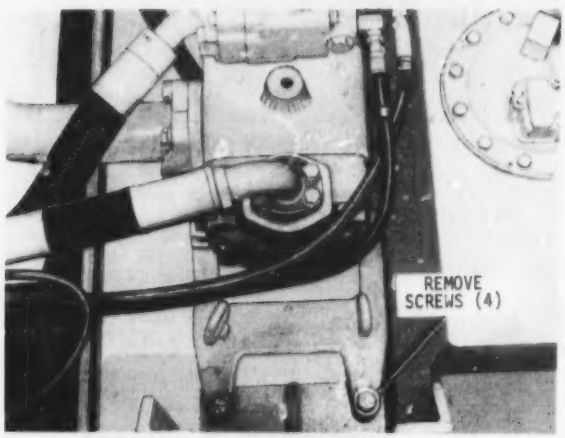

REMOVE SCREWS (4)
LOCK WASHERS (4)
REMOVE FLOOR SUPPORT
VIEW A. FLOOR SUPPORT.
LOOSEN SCREWS (2)
REMOVE CLAMPS (2)
VIEW B. UNIVERSAL BOOT.
DISCONNECT CABLE AT SENDING UNIT
DISCONNECT HYDRAULIC AND FUEL LINES (7)
DISCONNECT AND REMOVE FUEL LINES (2) AT TANK
DISCONNECT HYDRAULIC LINES (3)
VIEW C. ELECTRIC CABLE AND HYDRAULIC AND FUEL LINES.
PULL BOOT OUT OF WAY
REMOVE LOCKWIRE SCREWS (4) LOCKWASHERS (4) DISCONNECT DRIVE SHAFT
DISCONNECT HYDRAULIC LINES (2)
VIEW D. DRIVE SHAFT.
TA171217

Figure 2-31. Mechanical transmission and main hydraulic pump assembly—removal and installation (Sheet 1 of 2).

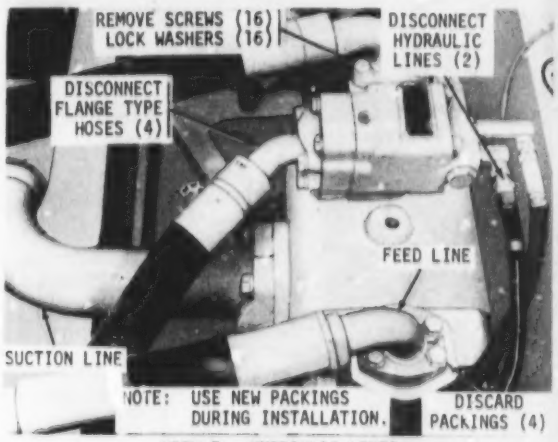
b. Installation. Install the mechanical transmission and main hydraulic pump assembly in reverse order of removal. Refer to TM 9-2350-256-20 for test of mechanical transmission oil pressure.

2-33. Mechanical Transmission Oil Cooler Assembly and Lines

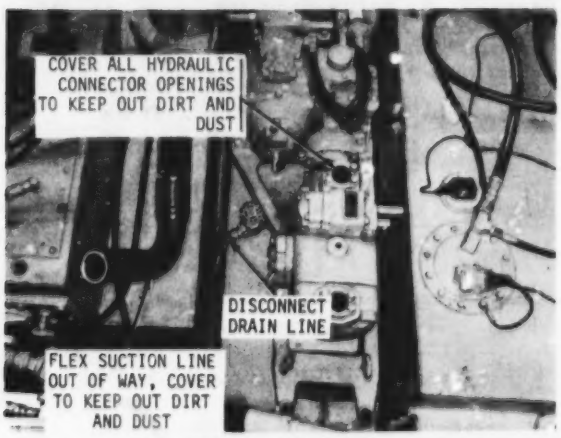
a. Removal. Prior to removal of the mechanical transmission oil cooler assembly and lines, remove power pack. Remove the mechanical transmission oil cooler assembly and oil lines as shown in figure 2-32.



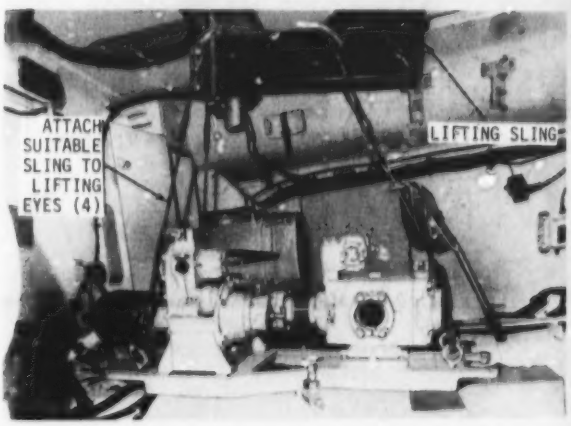
VIEW E. MOUNTING BOLTS.



VIEW F. HYDRAULIC LINES.


COVER ALL HYDRAULIC CONNECTOR OPENINGS TO KEEP OUT DIRT AND DUST
DISCONNECT DRAIN LINE
FLEX SUCTION LINE OUT OF WAY, COVER TO KEEP OUT DIRT AND DUST

VIEW G. DRAIN LINE.



VIEW H. REMOVE MECHANICAL TRANSMISSION AND PUMP ASSEMBLY THROUGH CUPOLA PLATE OPENING.

TA171216

Figure 2-31. Mechanical transmission and main hydraulic pump assembly—removal and installation (Sheet 2 of 2).

REMOVE OIL COOLER INLET LINE
REMOVE OIL COOLER OUTLET LINE
REMOVE OIL COOLER
REMOVE SCREWS (2) LOCK WASHERS (2) FLAT WASHERS (2)
REMOVE PIN (HIDDEN) AND MOVE ROD OUT OF WAY
TA039264

Figure 2-32. Mechanical transmission oil cooler assembly and lines—removal and installation.

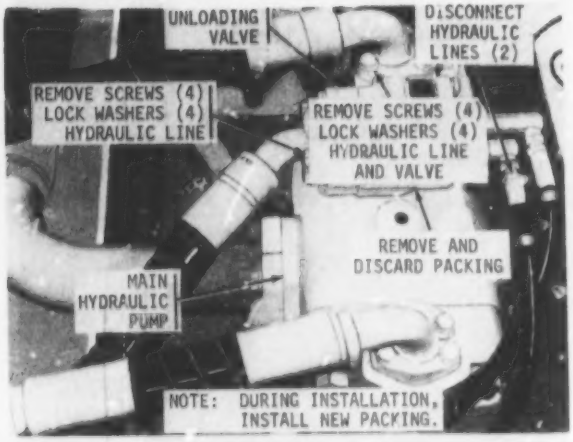

UNLOADING VALVE
DISCONNECT HYDRAULIC LINES (2)
REMOVE SCREWS (4) LOCK WASHERS (4) HYDRAULIC LINE
REMOVE SCREWS (4) LOCK WASHERS (4) HYDRAULIC LINE AND VALVE
REMOVE AND DISCARD PACKING
MAIN HYDRAULIC PUMP
NOTE: DURING INSTALLATION, INSTALL NEW PACKING.
TA016179

Figure 2-33. Main hydraulic pump unloading valve—removal and installation.

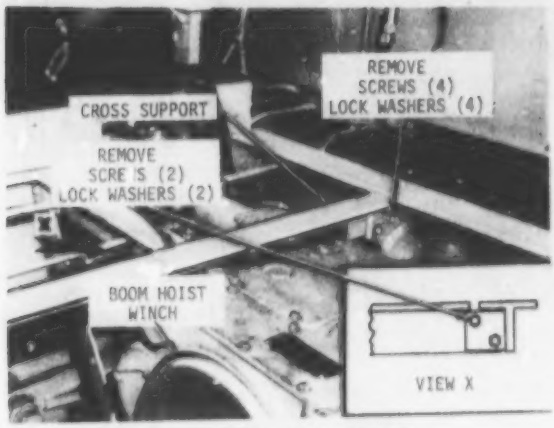
b. Installation. Install the mechanical transmission oil cooler assembly and lines in reverse order of removal.

2-34. Main Hydraulic Pump Unloading Valve

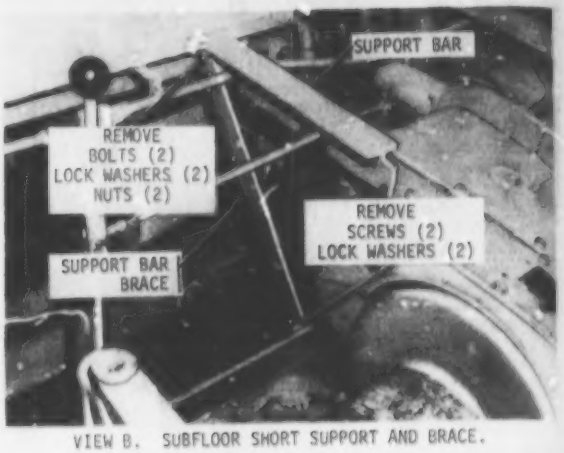
Prior to removing the main hydraulic pump unloading valve, remove subfloor plates 11, 12 and 14 (fig. 2-3) Remove and install the main hydraulic pump unloading valve as shown in figure 2-33.

2-35. Hoist Winch Assembly

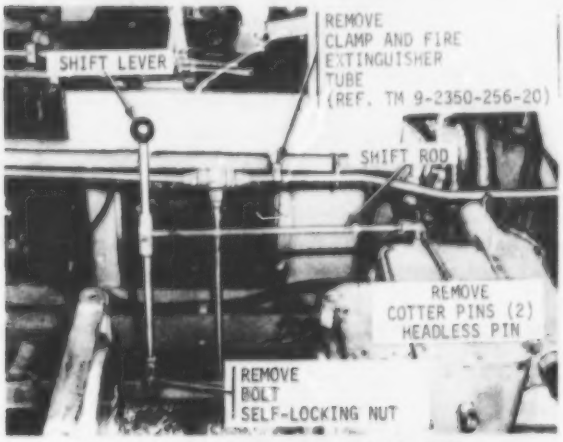
a. Removal. Prior to removing the hoist winch assembly, remove the hoist winch cable (para 2-23). Remove the cupola and cupola plate, commander's seat and hoist winch cable chute (TM 9-2350-256-20). Remove any oddment trays, racks and baskets, as required, to allow clearance and prevent damage. Remove subfloor plates 4, 5, 11, 17, 18, 19, 20, 21, and 24 (fig. 2-3). Remove hoist winch assembly as shown in figure 2-34.



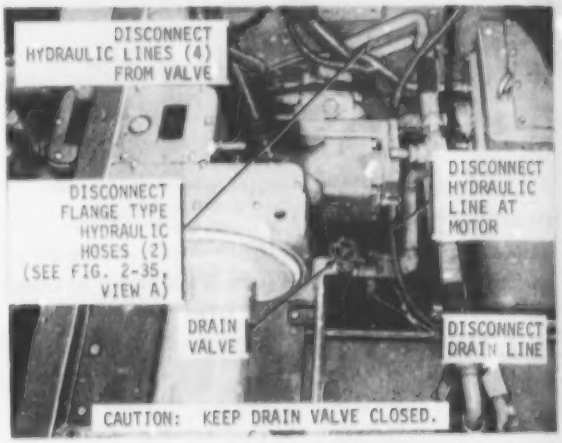
VIEW A. SUBFLOOR CROSS SUPPORT.



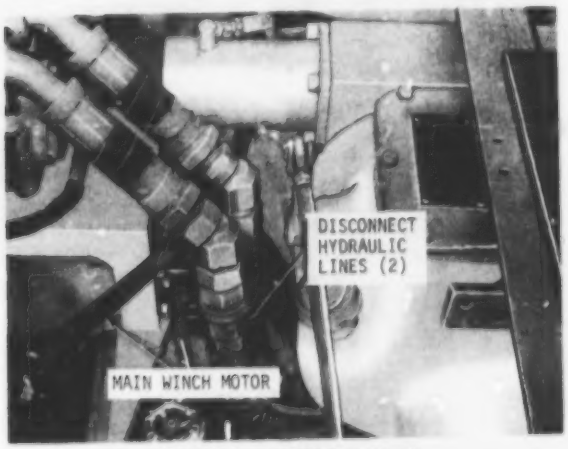
VIEW B. SUBFLOOR SHORT SUPPORT AND BRACE.



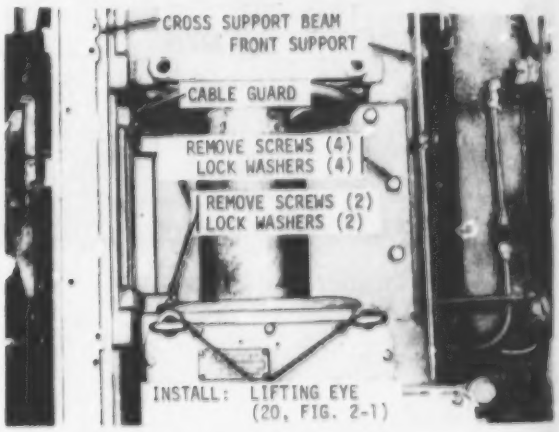
VIEW C. SHIFT ROD, LEVER AND CO_2 TUBE.



VIEW D. HYDRAULIC LINES.



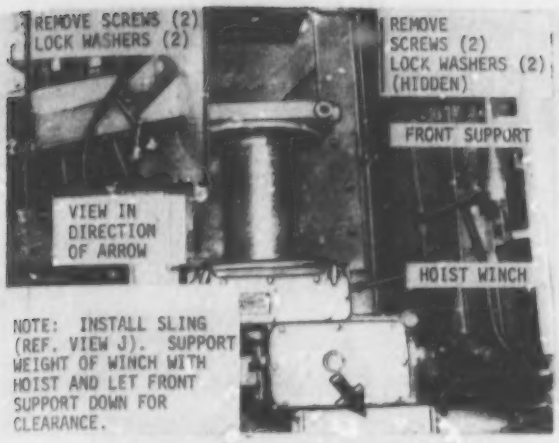
VIEW E. HYDRAULIC LINES.



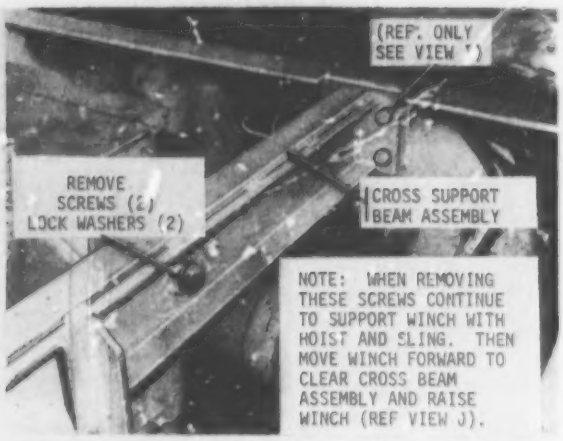
VIEW F. CABLE GUARD SCREWS AND FRONT SUPPORT SCREWS.

TA016163

Figure 2-34. Hoist winch assembly—removal and installation (Sheet 1 of 2).



VIEW G. HOIST WINCH FRONT SUPPORT.

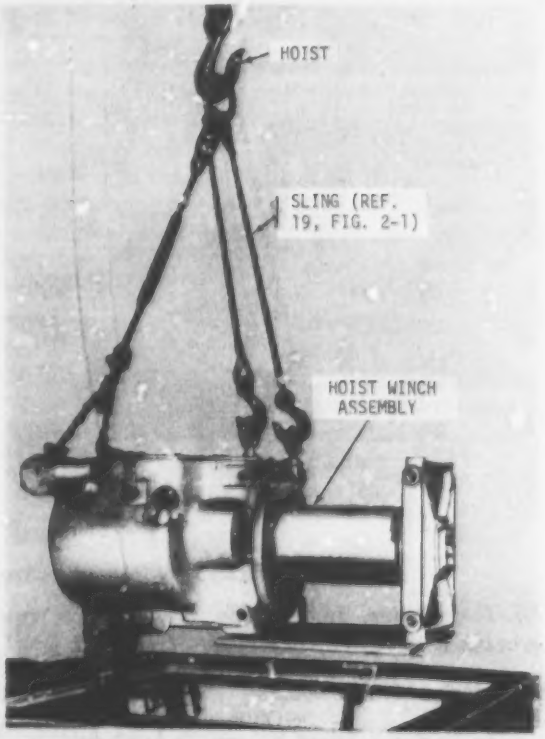


VIEW H. HOIST WINCH TO CROSS SUPPORT BEAM SCREWS.

NOTE:

1. OMIT OPERATION IN VIEW G.
2. REMOVE SCREWS (2) SECURING MECHANICAL TRANSMISSION AND HYDRAULIC PUMP TO CROSS SUPPORT BEAM.
3. RAISE AND BLOCK TRANSMISSION AND PUMP TO CLEAR CROSS SUPPORT BEAM.
4. MARK SHIMS SO THEY MAY BE INSTALLED IN SAME PLACE FROM WHICH THEY WERE REMOVED TO PREVENT MISALINEMENT OF WINCH AND MECHANICAL TRANSMISSION MOUNTING HOLES. REMOVE SHIMS.
5. TIP CROSS BEAM AND LIFT OUT OF WAY.
6. LIFT HOIST WINCH STRAIGHT UP (REF. VIEW J).

VIEW I. ALTERNATE METHOD INVOLVING REMOVAL OF CROSS SUPPORT BEAM.



VIEW J. REMOVING HOIST WINCH THROUGH CUPOLA PLATE OPENING.

TA016164

Figure 2-34. Hoist winch assembly—removal and installation (Sheet 2 of 2).

b. Installation. Install the hoist winch assembly in reverse order of removal.

2-36. Hoist Winch Counterbalance Valve

a. Removal. Remove subfloor plates 5, 11 (fig. 2-3). Remove the hoist winch counterbalance valve as shown in figure 2-35.

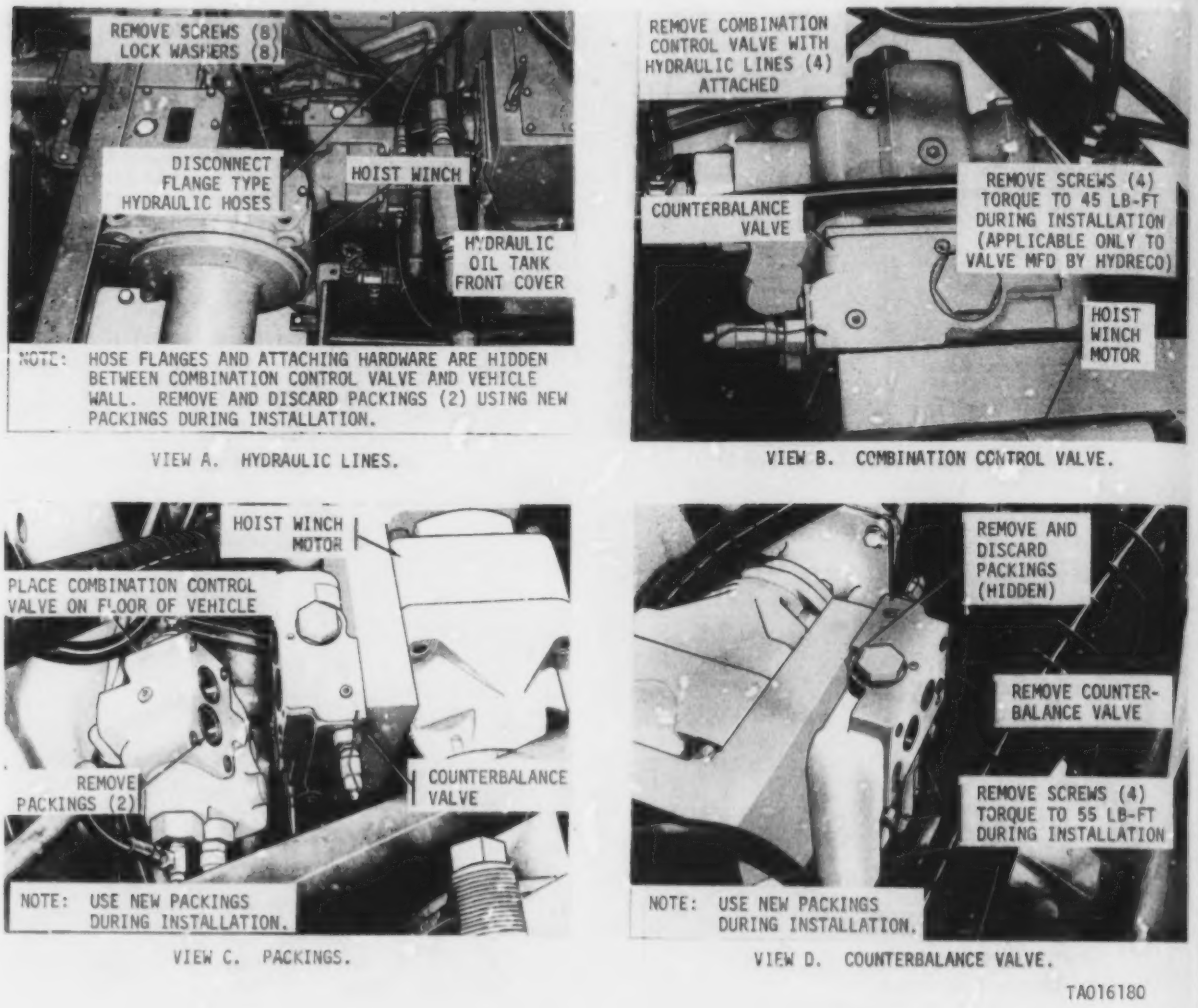

REMOVE SCREWS (8)
LOCK WASHERS (8)
DISCONNECT FLANGE TYPE HYDRAULIC HOSES
HOIST WINCH
HYDRAULIC OIL TANK FRONT COVER
NOTE: HOSE FLANGES AND ATTACHING HARDWARE ARE HIDDEN BETWEEN COMBINATION CONTROL VALVE AND VEHICLE WALL. REMOVE AND DISCARD PACKINGS (2) USING NEW PACKINGS DURING INSTALLATION.
VIEW A. HYDRAULIC LINES.
REMOVE COMBINATION CONTROL VALVE WITH HYDRAULIC LINES (4) ATTACHED
COUNTERBALANCE VALVE
REMOVE SCREWS (4) TORQUE TO 45 LB-FT DURING INSTALLATION (APPLICABLE ONLY TO VALVE MFD BY HYDRECO)
HOIST WINCH MOTOR
VIEW B. COMBINATION CONTROL VALVE.
HOIST WINCH MOTOR
PLACE COMBINATION CONTROL VALVE ON FLOOR OF VEHICLE
REMOVE PACKINGS (2)
COUNTERBALANCE VALVE
NOTE: USE NEW PACKINGS DURING INSTALLATION.
VIEW C. PACKINGS.
REMOVE AND DISCARD PACKINGS (HIDDEN)
REMOVE COUNTER-BALANCE VALVE
REMOVE SCREWS (4) TORQUE TO 55 LB-FT DURING INSTALLATION
NOTE: USE NEW PACKINGS DURING INSTALLATION.
VIEW D. COUNTERBALANCE VALVE.
TA016180

Figure 2-35. Hoist winch counterbalance valve—removal and installation.

b. Installation. Install the hoist winch counterbalance valve in reverse order of removal.

2-37. Hoist Winch Motor

NOTE

Use Hydraulic Motor Kit, 11672161 on retrofitted vehicles when replacing a motor which is not a Dennison Model No. M4E-185-3N00-B101-M40712.

a. Removal. Prior to removing the hoist winch motor, remove the hoist winch counterbalance valve (para 2-36). Remove the hoist winch motor as shown in figure 2-36.

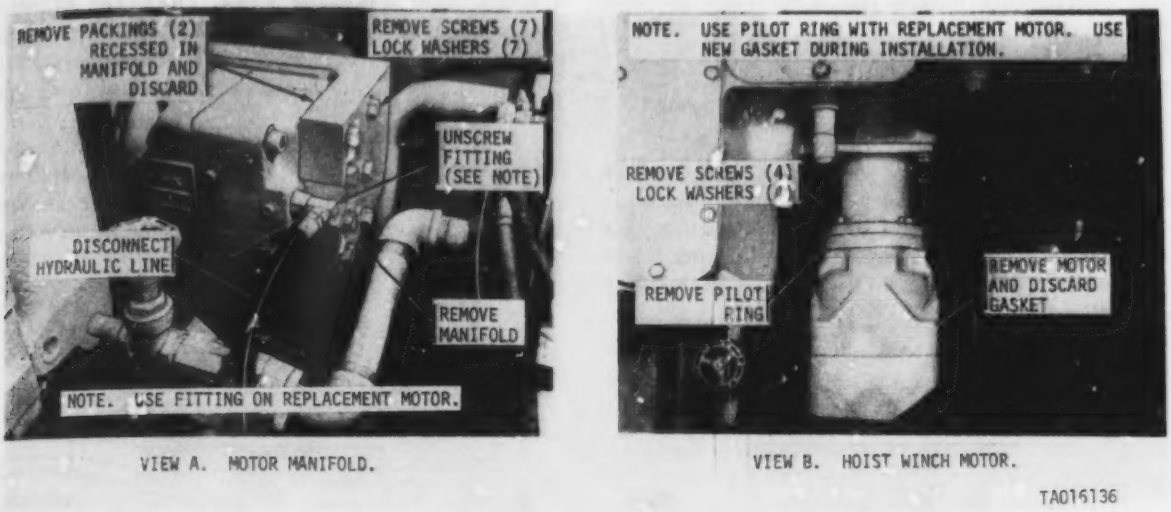

REMOVE PACKINGS (2) RECESSED IN MANIFOLD AND DISCARD
REMOVE SCREWS (7) LOCK WASHERS (7)
UNSCREW FITTING (SEE NOTE)
DISCONNECT HYDRAULIC LINE
REMOVE MANIFOLD
NOTE. USE FITTING ON REPLACEMENT MOTOR.
VIEW A. MOTOR MANIFOLD.
NOTE. USE PILOT RING WITH REPLACEMENT MOTOR. USE NEW GASKET DURING INSTALLATION.
REMOVE SCREWS (4) LOCK WASHERS (4)
REMOVE PILOT RING
REMOVE MOTOR AND DISCARD GASKET
VIEW B. HOIST WINCH MOTOR.
TA016136

Figure 2-36. Hoist winch motor—removal and installation.

b. Installation. Install the hoist winch motor and manifold in reverse order of removal.

2-38. Main Winch and Hoist Winch Brake Cylinders

a. General. The main winch and hoist winch brake cylinders are identical and are replaced in the same manner. Remove subfloor plate 2 (fig. 2-3) for access to the main winch brake adjusting screw and open subfloor plate 5 (fig. 2-3) for access to the hoist winch brake adjusting screw. The brake adjusting screw, which compresses the brake cylinder springs, must be loosened prior to removal of the brake cylinder and readjusted after installation.

b. Removal. Remove subfloor plate 3 (fig. 2-3) for main winch brake cylinder and plate 4 for hoist winch brake cylinder access. Remove the main winch or hoist winch brake cylinder as shown in figure 2-37.

c. Test. Prior to installation, test the main winch or hoist winch brake cylinder as shown in View C, figure 2-37.

d. Installation. Install the main winch or hoist winch brake cylinder and adjust in reverse order of removal.

2-39. Main Winch and Hoist Winch Brake Band Assemblies

a. General. The main winch and hoist winch brake band assemblies are removed and replaced in the same manner. Remove subfloor plate 2 (fig. 2-3) for access to the main winch brake adjusting screw and subfloor plate 5 (fig. 2-3) for access to the hoist winch brake adjusting screw. The brake adjusting screw (View B, fig. 2-38), which compresses the brake cylinder springs, must be loosened prior to removing the brake band assembly and readjusted during installation.

b. Removal. Remove subfloor plate 1 (fig. 2-3) for access to the main winch brake band assembly or plate 5 (fig. 2-3) for the hoist winch brake band assembly. Remove and install brake band assemblies as shown in figure 2-38.

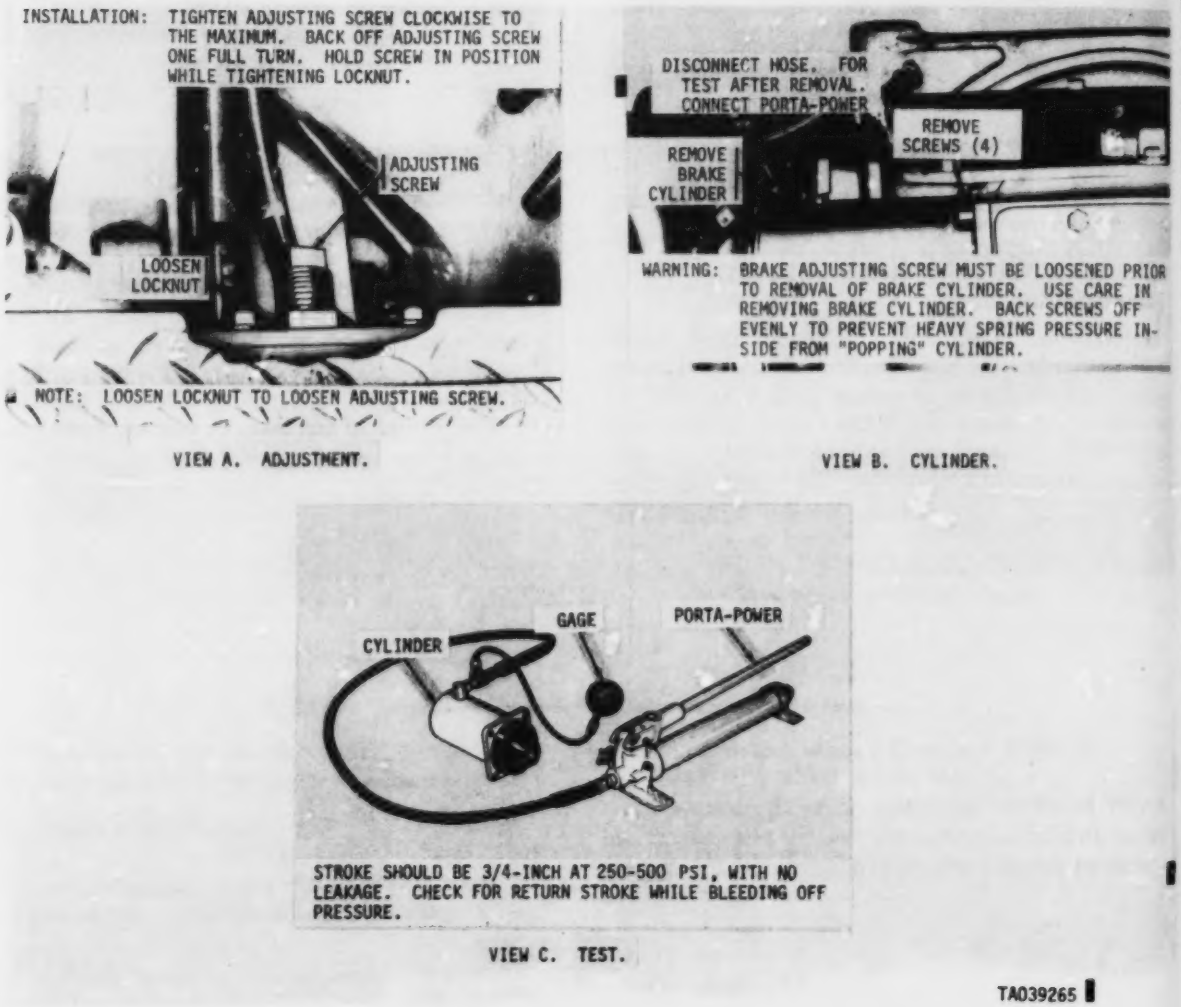

INSTALLATION: TIGHTEN ADJUSTING SCREW CLOCKWISE TO THE MAXIMUM. BACK OFF ADJUSTING SCREW ONE FULL TURN. HOLD SCREW IN POSITION WHILE TIGHTENING LOCKNUT.
ADJUSTING SCREW
LOOSEN LOCKNUT
NOTE: LOOSEN LOCKNUT TO LOOSEN ADJUSTING SCREW.
VIEW A. ADJUSTMENT.
DISCONNECT HOSE. FOR TEST AFTER REMOVAL. CONNECT PORTA-POWER
REMOVE SCREWS (4)
REMOVE BRAKE CYLINDER
WARNING: BRAKE ADJUSTING SCREW MUST BE LOOSENED PRIOR TO REMOVAL OF BRAKE CYLINDER. USE CARE IN REMOVING BRAKE CYLINDER. BACK SCREWS OFF EVENLY TO PREVENT HEAVY SPRING PRESSURE INSIDE FROM "POPPING" CYLINDER.
VIEW B. CYLINDER.
CYLINDER
GAGE
PORTA-POWER
STROKE SHOULD BE 3/4-INCH AT 250-500 PSI, WITH NO LEAKAGE. CHECK FOR RETURN STROKE WHILE BLEEDING OFF PRESSURE.
VIEW C. TEST.
TA039265

Figure 2-37. Winch brake cylinder—removal, test, installation and adjustment.

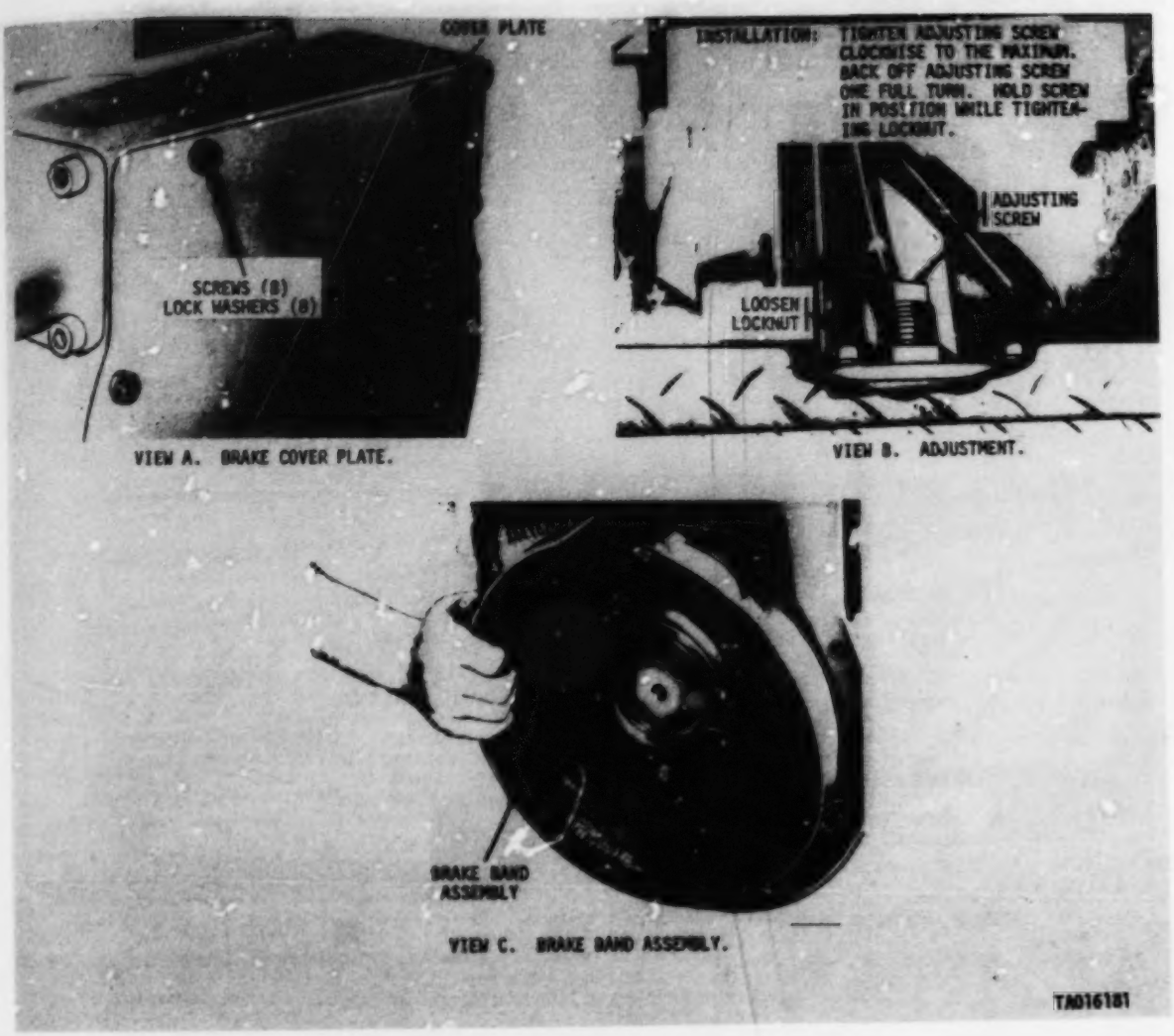

COVER PLATE
SCREWS (8)
LOCK WASHERS (8)
VIEW A. BRAKE COVER PLATE.
INSTALLATION: TIGHTEN ADJUSTING SCREW CLOCKWISE TO THE MAXIMUM. BACK OFF ADJUSTING SCREW ONE FULL TURN. HOLD SCREW IN POSITION WHILE TIGHTENING LOCKNUT.
ADJUSTING SCREW
LOOSEN LOCKNUT
VIEW B. ADJUSTMENT.
BRAKE BAND ASSEMBLY
VIEW C. BRAKE BAND ASSEMBLY.
TA016181

Figure 2-38. Winch brake band assemblies—removal and installation.

2-40. Hydraulic System Oil Tank Assembly.

a. General. All hydraulic oil tank accessories can be replaced with the tank installed in the vehicle. Refer to paragraphs 2-41, 2-42, and 2-43 for removal of the filter, strainer, covers and fittings on the top front cover. Refer to TM 9-2350-256-20 for removal of the gage rod, drain valve, lifting bolts and fittings on front cover and top rear cover.

b. Removal. Prior to removing the oil tank assembly, remove cupola and cupola plate, rigger's seat and necessary subfloor plates (TM 9-2350-256-20). Drain the hydraulic system oil tank assembly and remove as shown in figure 2-39.

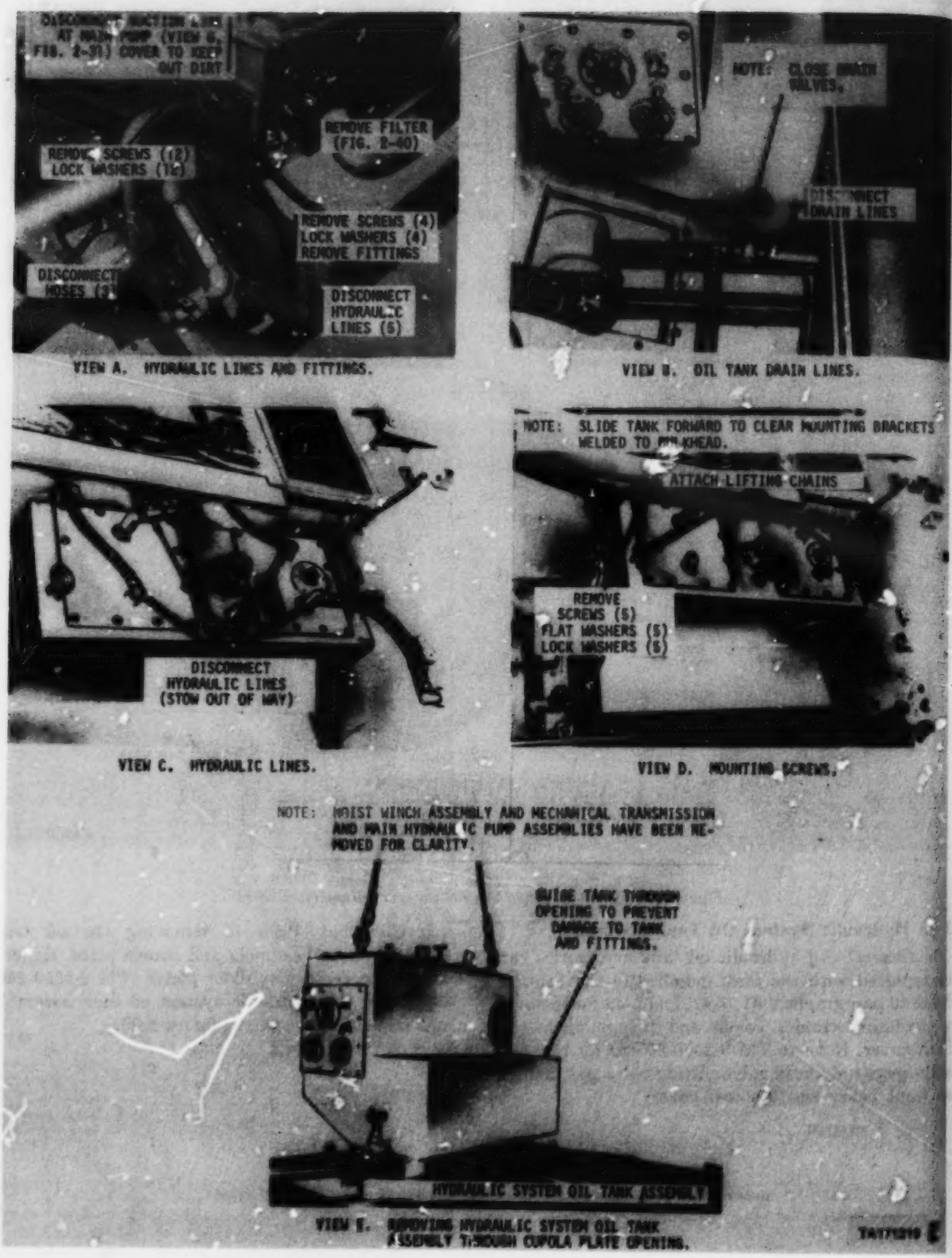

REMOVE FILTER (FIG. 2-40)
REMOVE SCREWS (12) LOCK WASHERS (12)
REMOVE SCREWS (4) LOCK WASHERS (4) REMOVE FITTINGS
DISCONNECT HYDRAULIC LINES (5)
VIEW A. HYDRAULIC LINES AND FITTINGS.
NOTE: CLOSE DRAIN VALVES.
VIEW B. OIL TANK DRAIN LINES.
DISCONNECT HYDRAULIC LINES (STOW OUT OF WAY)
VIEW C. HYDRAULIC LINES.
NOTE: SLIDE TANK FORWARD TO CLEAR MOUNTING BRACKETS WELDED TO BULKHEAD.
ATTACH LIFTING CHAINS
REMOVE SCREWS (5) FLAT WASHERS (5) LOCK WASHERS (5)
VIEW D. MOUNTING SCREWS.
NOTE: HOIST WINCH ASSEMBLY AND MECHANICAL TRANSMISSION AND MAIN HYDRAULIC PUMP ASSEMBLIES HAVE BEEN REMOVED FOR CLARITY.
GUIDE TANK THROUGH OPENING TO PREVENT DAMAGE TO TANK AND FITTINGS.
HYDRAULIC SYSTEM OIL TANK ASSEMBLY
VIEW E. REMOVING HYDRAULIC SYSTEM OIL TANK ASSEMBLY THROUGH CUPOLA PLATE OPENING.
TA171210

Figure 2-39. Hydraulic system oil tank—removal and installation.

c. Installation. Install the hydraulic system oil tank in reverse order of removal. Fill tank (LO 9-2350-256-12).

2-41. Hydraulic System Oil Filter

a. Removal. Prior to removal of the oil filter, drain the oil tank below the level of the filter and remove subfloor plates 9, 19 (fig. 2-3) for access. Remove the hydraulic system oil filter from the oil tank as shown in figure 2-40.

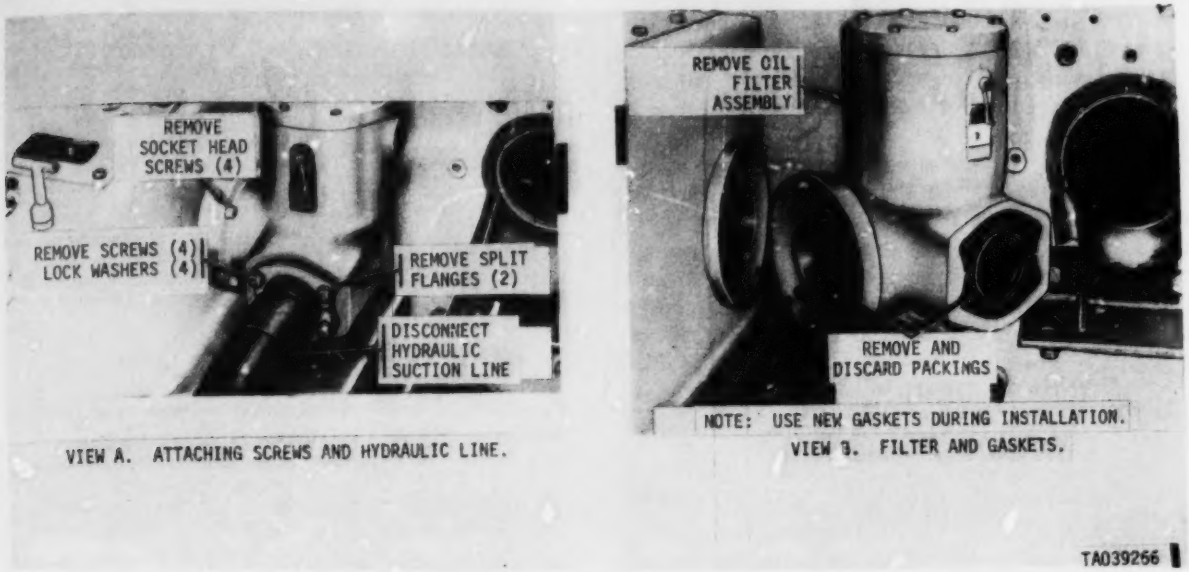

REMOVE SOCKET HEAD SCREWS (4)
REMOVE SCREWS (4) LOCK WASHERS (4)
REMOVE SPLIT FLANGES (2)
DISCONNECT HYDRAULIC SUCTION LINE
VIEW A. ATTACHING SCREWS AND HYDRAULIC LINE.
REMOVE OIL FILTER ASSEMBLY
REMOVE AND DISCARD PACKINGS
NOTE: USE NEW GASKETS DURING INSTALLATION.
VIEW B. FILTER AND GASKETS.
TA039256

Figure 2-40. Hydraulic system oil filter—removal and installation.

b. Installation. Install the hydraulic system oil filter in reverse order of removal and fill tank (LO 9-2350-256-12).

2-42. Hydraulic Oil Tank Strainer (Filter)

Prior to removing the oil tank strainer, remove subfloor plate 10 (fig. 2-3) for access. Remove, service and install the oil tank strainer as shown in figure 2-41.

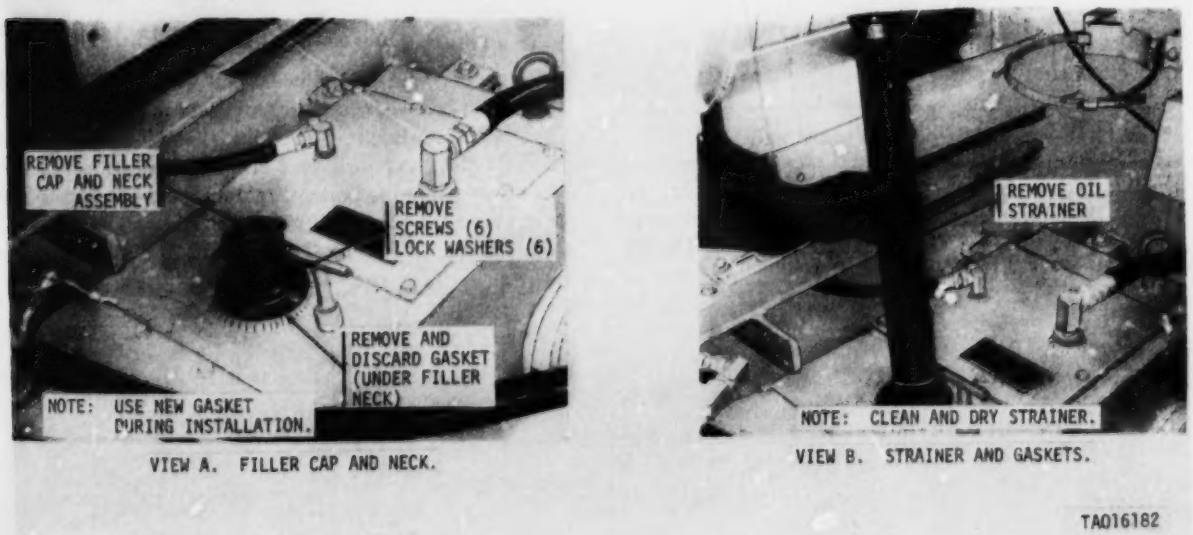

REMOVE FILLER CAP AND NECK ASSEMBLY
REMOVE SCREWS (6) LOCK WASHERS (6)
REMOVE AND DISCARD GASKET (UNDER FILLER NECK)
NOTE: USE NEW GASKET DURING INSTALLATION.
VIEW A. FILLER CAP AND NECK.
REMOVE OIL STRAINER
NOTE: CLEAN AND DRY STRAINER.
VIEW B. STRAINER AND GASKETS.
TA016182

Figure 2-41. Hydraulic oil tank strainer (filter)—removal, service and installation.

2-43. Hydraulic Oil Tank Cover Assemblies and Suction Pipe

a. Hydraulic Oil Tank Top Cover Assemblies.

(1) *Removal.* Prior to removing the oil tank front and rear top cover assemblies, remove subfloor plates 9, 10, 11 (fig. 2-3), disconnect five hydraulic lines (View C, fig. 2-39) and remove fittings (TM 9-2350-256-20). Remove the oil tank top cover assemblies as shown in figure 2-42.

(2) *Installation.* Install the hydraulic oil tank front and rear top cover assemblies in reverse order of removal.

b. Hydraulic Oil Tank Front Cover Assembly.

(1) *Removal.* Prior to removing the oil tank front cover assembly, remove subfloor plate 11 (fig. 2-3), drain the tank below the level of the cover, disconnect hydraulic lines (View A, fig. 2-39) and remove fittings (TM 9-2350-256-20). Remove the oil tank front cover assembly in the same manner as the top cover assemblies (fig. 2-42).

(2) *Installation.* Install the oil tank front cover assembly in reverse order of removal and fill tank (LO 9-2350-256-12).

c. Hydraulic Oil Tank Suction Pipe.

(1) *Removal.* The suction pipe is located inside the oil tank directly behind the oil filter. Prior to removing the suction pipe, drain the oil tank below the level of the filter and remove the top rear tank cover (*a* above). Remove four screws and lock washers and the two split flanges holding the suction pipe. Remove the suction pipe and packing.

(2) *Installation.* Install the suction pipe and packing in reverse order of removal and refill the tank (LO 9-2350-256-12).

2-44. Forward Fuel Tank Assembly

NOTE

The tank may be stripped of all fittings, fuel pump and sending unit, while installed, for ventilation purposes (TM 9-2350-256-20).

a. Prior Operations. Prior to removal of the forward fuel tank, perform the following operations:

(1) Remove commander's and rigger's seats, hoist winch cable chute and the drain valve controls and control lever bracket (TM 9-2350-256-20). Remove subfloor plates 4, 5, 9, 10, 11, 12, 13, 14, 17, 18, 20, 21, 22 and 24 (fig. 2-3).

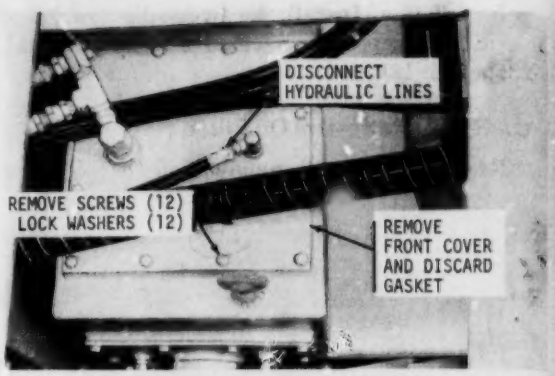

DISCONNECT HYDRAULIC LINES
REMOVE SCREWS (12) LOCK WASHERS (12)
REMOVE FRONT COVER AND DISCARD GASKET
NOTE: TO REMOVE TOP REAR COVER, DISCONNECT 2 HYDRAULIC LINES AND REMOVE IN SAME MANNER AS TOP FRONT COVER. USE NEW GASKETS DURING INSTALLATION.
TA016183

Figure 2-42. Hydraulic oil tank top covers—removal and installation.

(2) Remove main winch and spade assembly (para 2-25) and hoist winch assembly (para 2-35). Remove mechanical transmission and hydraulic pump assembly (para 2-32) and hydraulic system oil tank assembly (para 2-40).

(3) Disconnect mechanical transmission power takeoff drive shaft at main engine and remove shaft entirely (fig. 2-30).

(4) Remove auxiliary power unit control box and bracket and the shift and throttle control components mounted on floor plates (TM 9-2350-256-20). Remove any stowage racks and boxes interfering with removal of the tank (TM 9-2350-256-20).

(5) Support rear (lower) end of hydraulic control panel (subplate) by opening operator's and mechanic's hatches and looping a chain through the hatches. Secure the chain to lower end of panel to support it. Remove attaching bolts at rear support bracket and remove subfloor plate 1 (fig. 2-3).

b. Removal. Remove the forward fuel tank assembly as shown in figure 2-43.

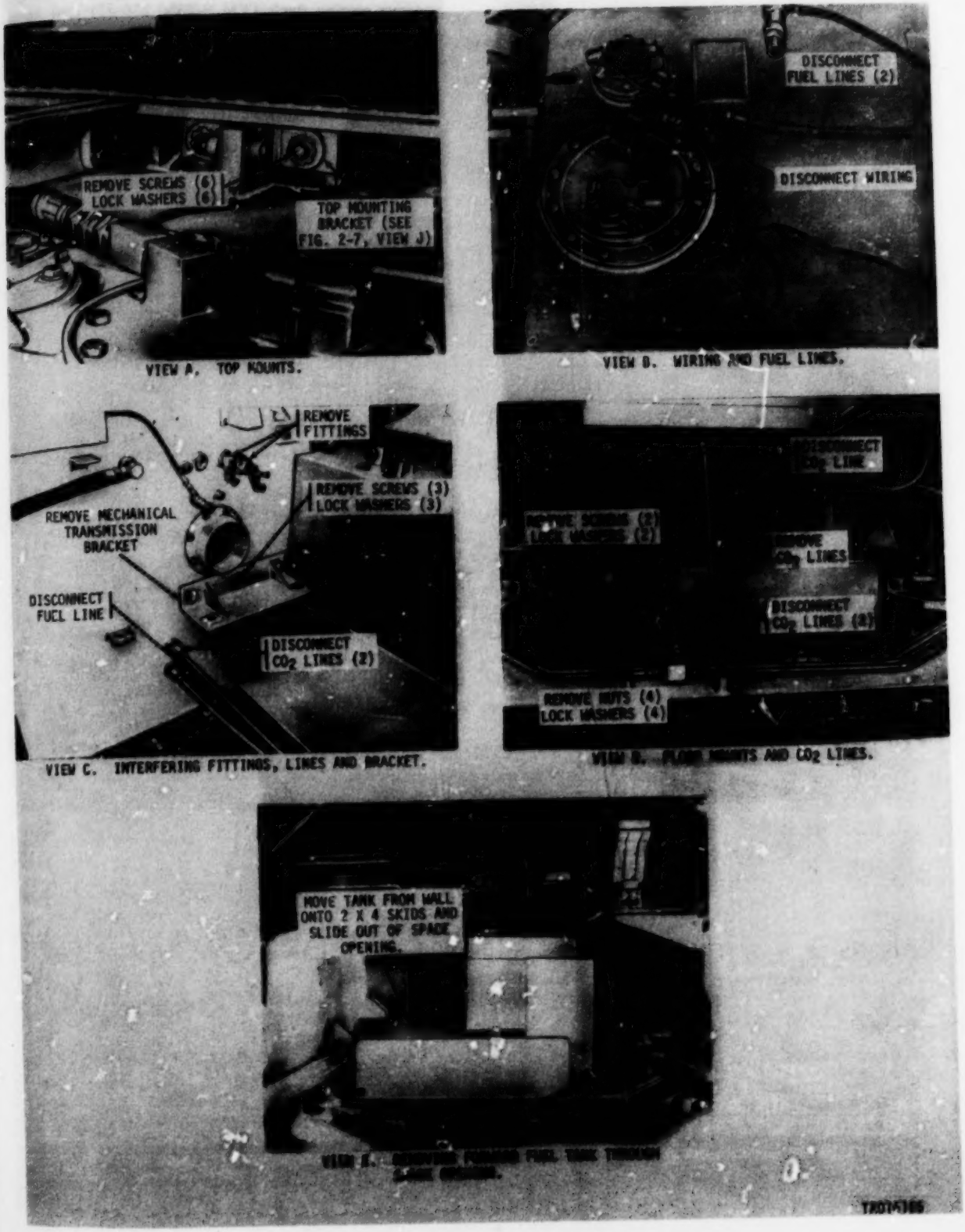

REMOVE SCREWS (6)
LOCK WASHERS (6)
TOP MOUNTING BRACKET (SEE FIG. 2-7, VIEW J)
VIEW A. TOP MOUNTS.
DISCONNECT FUEL LINES (2)
DISCONNECT WIRING
VIEW B. WIRING AND FUEL LINES.
REMOVE FITTINGS
REMOVE SCREWS (3)
LOCK WASHERS (3)
REMOVE MECHANICAL TRANSMISSION BRACKET
DISCONNECT FUEL LINE
DISCONNECT CO_2 LINES (2)
VIEW C. INTERFERING FITTINGS, LINES AND BRACKET.
REMOVE NUTS (4)
LOCK WASHERS (4)
MOVE TANK FROM WALL ONTO 2 X 4 SKIDS AND SLIDE OUT OF SPACE OPENING.
TA014385

Figure 2-43. Forward fuel tank—removal and installation.

c. Installation. Install the forward fuel tank in reverse order of removal.

2-45. Fuel Transfer Pump and Auxiliary Hydraulic Motor Assembly

a. Removal. Prior to removing the fuel transfer pump and auxiliary hydraulic motor assembly, remove engine deck (TM 9-2350-256-20) and open deck doors 7 and 8 (fig. 2-2). Remove the fuel transfer pump and motor assembly as shown in figure 2-44.

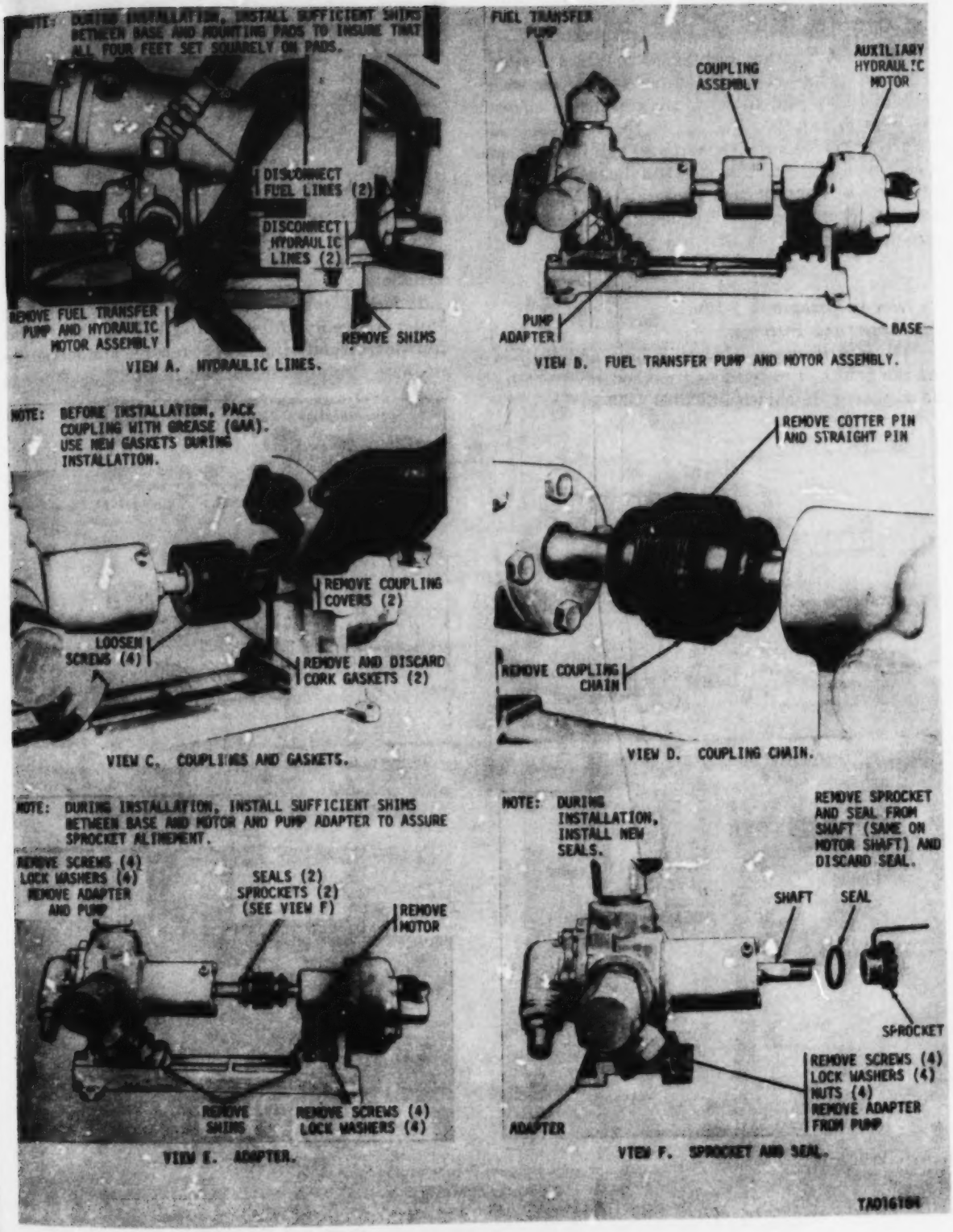

NOTE: DURING INSTALLATION, INSTALL SUFFICIENT SHIMS BETWEEN BASE AND MOUNTING PADS TO INSURE THAT ALL FOUR FEET SET SQUARELY ON PADS.
DISCONNECT FUEL LINES (2)
DISCONNECT HYDRAULIC LINES (2)
REMOVE FUEL TRANSFER PUMP AND HYDRAULIC MOTOR ASSEMBLY
REMOVE SHIMS
VIEW A. HYDRAULIC LINES.
FUEL TRANSFER PUMP
COUPLING ASSEMBLY
AUXILIARY HYDRAULIC MOTOR
PUMP ADAPTER
BASE
VIEW B. FUEL TRANSFER PUMP AND MOTOR ASSEMBLY.
NOTE: BEFORE INSTALLATION, PACK COUPLING WITH GREASE (GAA). USE NEW GASKETS DURING INSTALLATION.
REMOVE COUPLING COVERS (2)
LOOSEN SCREWS (4)
REMOVE AND DISCARD CORK GASKETS (2)
VIEW C. COUPLINGS AND GASKETS.
REMOVE COTTER PIN AND STRAIGHT PIN
REMOVE COUPLING CHAIN
VIEW D. COUPLING CHAIN.
NOTE: DURING INSTALLATION, INSTALL SUFFICIENT SHIMS BETWEEN BASE AND MOTOR AND PUMP ADAPTER TO ASSURE SPROCKET ALIGNMENT.
REMOVE SCREWS (4) LOCK WASHERS (4) REMOVE ADAPTER AND PUMP
SEALS (2) SPROCKETS (2) (SEE VIEW F)
REMOVE MOTOR
REMOVE SHIMS
REMOVE SCREWS (4) LOCK WASHERS (4)
VIEW E. ADAPTER.
NOTE: DURING INSTALLATION, INSTALL NEW SEALS.
REMOVE SPROCKET AND SEAL FROM SHAFT (SAME ON MOTOR SHAFT) AND DISCARD SEAL.
SHAFT
SEAL
SPROCKET
REMOVE SCREWS (4) LOCK WASHERS (4) NUTS (4) REMOVE ADAPTER FROM PUMP
ADAPTER
VIEW F. SPROCKET AND SEAL.
TA016184

Figure 2-44. Fuel transfer pump and auxiliary hydraulic motor assembly—removal and installation.

b. Installation. Install the fuel transfer pump and auxiliary hydraulic motor assembly in reverse order of removal.

2-46. Miscellaneous Hydraulic Components

a. General. Various miscellaneous valves located at several points about the vehicle, together with hydraulic lines and fittings, are considered collectively as a major component in the removal and installation procedure. The removal and installation of each component is described and illustrated in the following sections of this paragraph. Remove interfering components as required for access for various points.

NOTE

Prior to disconnecting any hydraulic lines, refer to paragraph 2-10b.

b. Lines and Fittings.

(1) *Identification.* Hydraulic lines and fittings and the points of support and method of attaching the supports are shown in TM 9-2350-256-20. The lines connecting units of the vehicle's hydraulic system consist primarily of the flexible high-pressure rubber hose and metal fittings. For identification, each hose is marked with its part number in one place and its code number at 36-inch intervals along its length. Code numbers and port routing of each hydraulic line are listed in TM 9-2350-256-20. Refer to TM 9-2350-256-34-2 for schematic diagrams identifying and locating ports.

(2) *Removal and Installation.* Refer to TM 9-2350-256-20 for removal and installation of hydraulic lines and fittings.

c. Pressure Switch Assembly. Refer to TM 9-2350-256-20 for removal and installation instructions.

d. Fuel Transfer Pump and Auxiliary Hydraulic Motor Assembly Motor Control Valve. Open engine deck doors 3 and 4 (fig. 2-3) to remove and install the auxiliary hydraulic motor control valve as shown in figure 2-45.

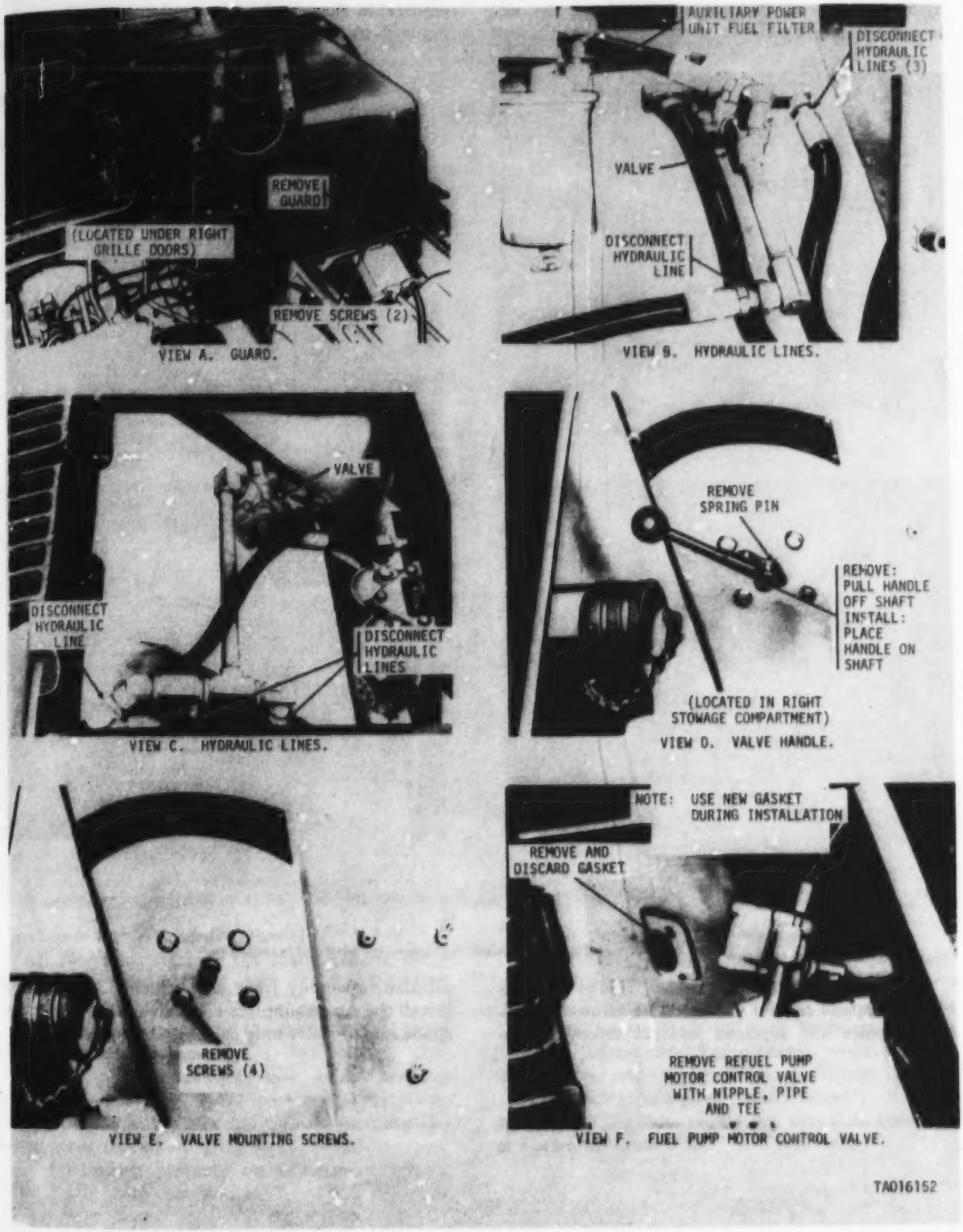

REMOVE GUARD
(LOCATED UNDER RIGHT GRILLE DOORS)
REMOVE SCREWS (2)
VIEW A. GUARD.
AUXILIARY POWER UNIT FUEL FILTER
DISCONNECT HYDRAULIC LINES (3)
VALVE
DISCONNECT HYDRAULIC LINE
VIEW B. HYDRAULIC LINES.
VALVE
DISCONNECT HYDRAULIC LINE
DISCONNECT HYDRAULIC LINES
VIEW C. HYDRAULIC LINES.
REMOVE SPRING PIN
REMOVE: PULL HANDLE OFF SHAFT
INSTALL: PLACE HANDLE ON SHAFT
(LOCATED IN RIGHT STOWAGE COMPARTMENT)
VIEW D. VALVE HANDLE.
REMOVE SCREWS (4)
VIEW E. VALVE MOUNTING SCREWS.
NOTE: USE NEW GASKET DURING INSTALLATION
REMOVE AND DISCARD GASKET
REMOVE REFUEL PUMP MOTOR CONTROL VALVE WITH NIPPLE, PIPE AND TEE
VIEW F. FUEL PUMP MOTOR CONTROL VALVE.
TA016152

Figure 2-45. Fuel transfer pump and auxiliary hydraulic motor assembly motor control valve—removal and installation.

e. Adjustable Flow Hydraulic Regulator. The hydraulic lines to be disconnected from the adjustable flow hydraulic regulator are located under deck grilles 3 and 4 (fig. 2-2). Remove and install the adjustable flow hydraulic regulator as shown in figure 2-46.

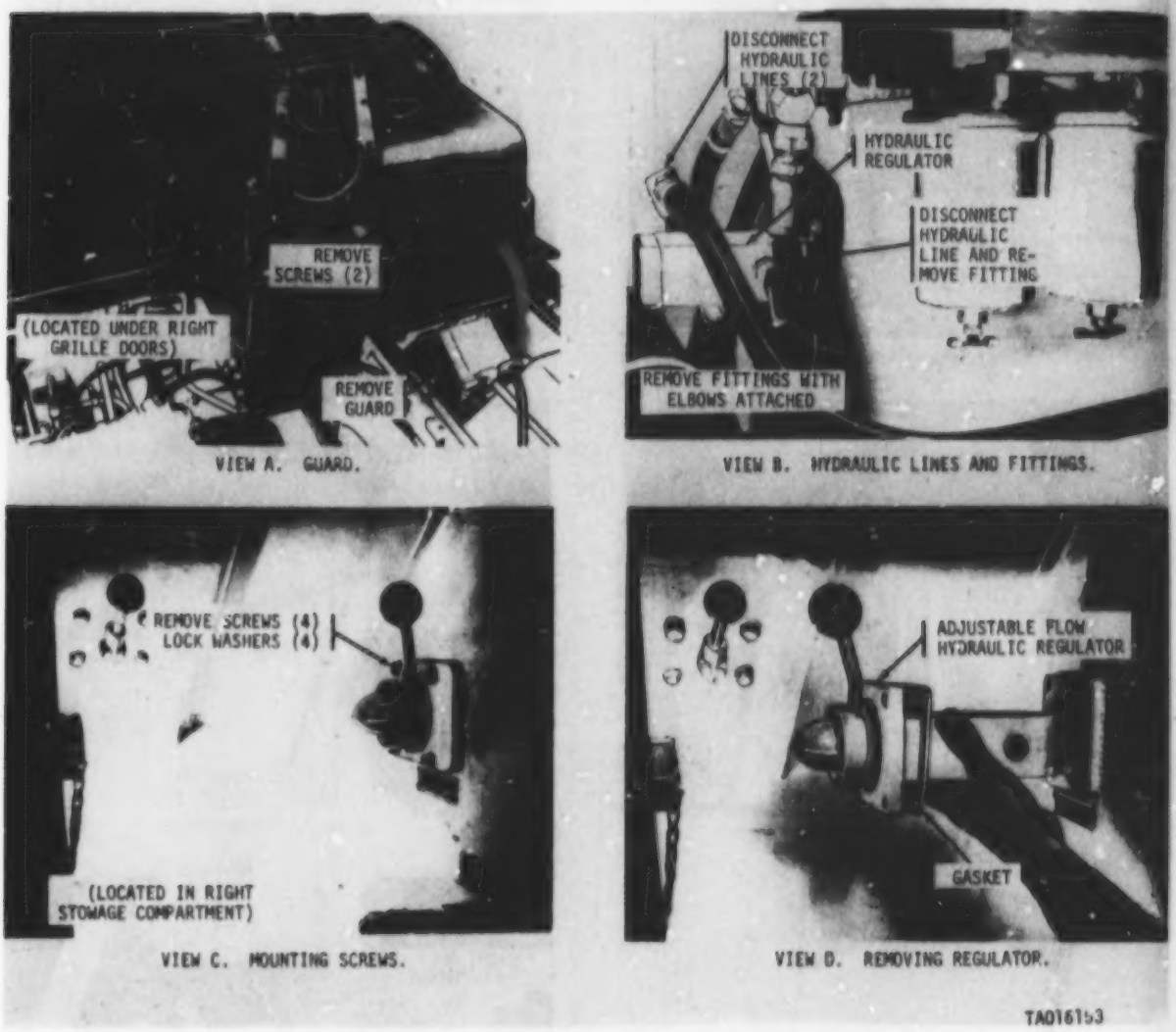


Figure 2-46. Adjustable flow hydraulic regulator—removal and installation.

f. Spade Subplate and Control Valve Assembly. The spade control valve can be removed from the subplate and replaced without removing the subplate assembly from the vehicle. Remove and install the spade subplate and valve assembly or the spade control valve only as shown in figure 2-47.

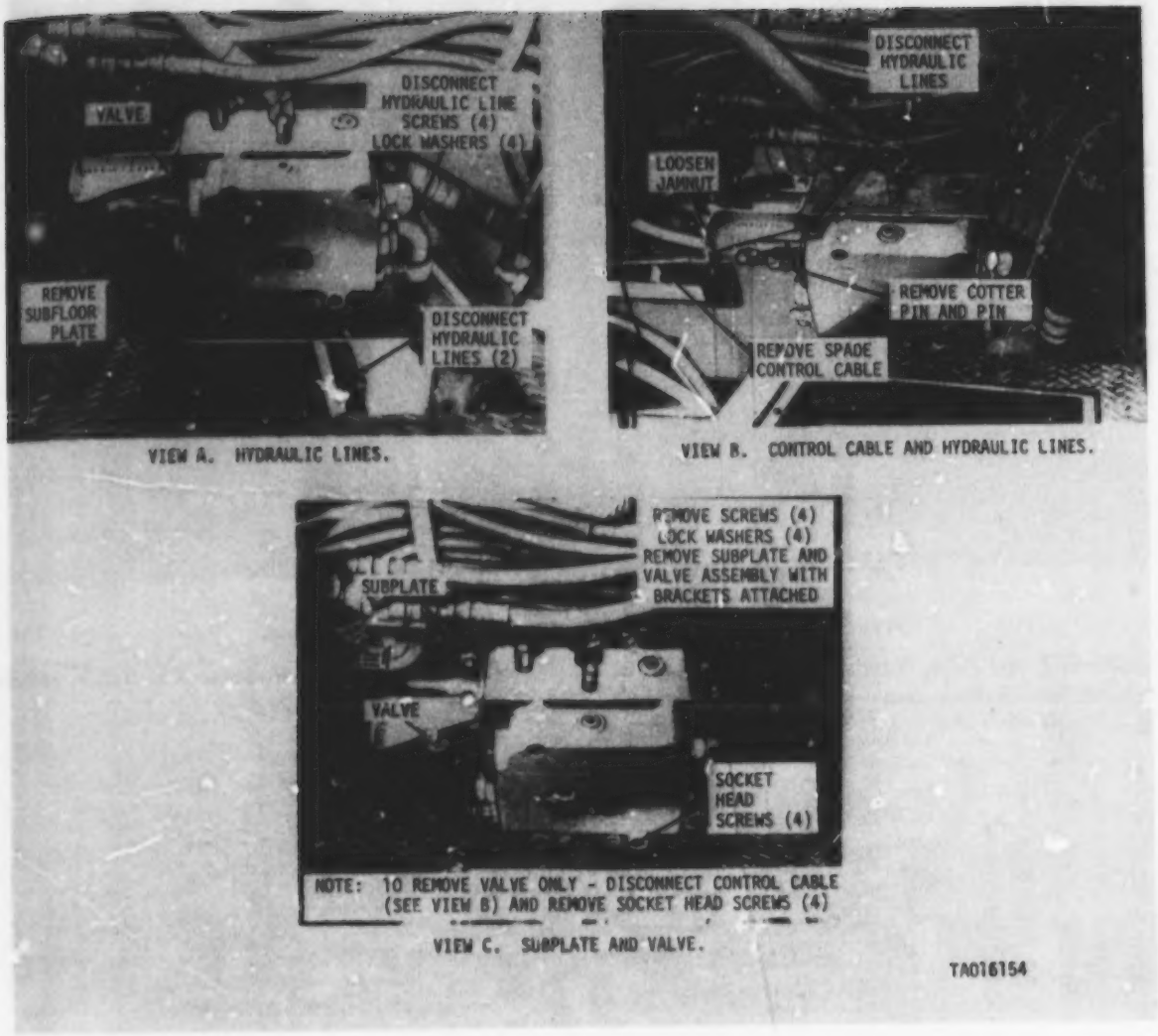

VALVE
DISCONNECT HYDRAULIC LINE SCREWS (4) LOCK WASHERS (4)
REMOVE SUBFLOOR PLATE
DISCONNECT HYDRAULIC LINES (2)
VIEW A. HYDRAULIC LINES.
DISCONNECT HYDRAULIC LINES
LOOSEN JAMNUT
REMOVE COTTER PIN AND PIN
REMOVE SPADE CONTROL CABLE
VIEW B. CONTROL CABLE AND HYDRAULIC LINES.
REMOVE SCREWS (4) LOCK WASHERS (4) REMOVE SUBPLATE AND VALVE ASSEMBLY WITH BRACKETS ATTACHED
SUBPLATE
VALVE
SOCKET HEAD SCREWS (4)
NOTE: TO REMOVE VALVE ONLY - DISCONNECT CONTROL CABLE (SEE VIEW B) AND REMOVE SOCKET HEAD SCREWS (4)
VIEW C. SUBPLATE AND VALVE.
TA016154

Figure 2-47. Spade subplate and control valve assembly—removal and installation.

g. Spade Cable Control Assembly.

(1) *Removal.* Remove the spade control cable as shown in Views F, G, H and I of figure 2-28 and View B of figure 2-47.

(2) *Installation.* Install the spade control cable in reverse order of removal.

(3) *Adjustment.* Install new cable keeping jamnuts (View B, fig. 2-47) loose for adjustment. Center spade control lever and tighten jamnuts. To adjust lever travel:

(*a*) Loosen jamnuts on adjustment screws (View F, fig. 2-28).

(*b*) Backoff adjustment screws.

(*c*) Move spade control lever completely back. Adjust screw until it touches lever and add one full turn. Tighten jamnut.

(*d*) Repeat step (*c*) with lever completely forward. Adjust front adjustment screw until it touches lever and add one full turn. Tighten jamnut.

h. Flow Regulating Subplate Assembly. Remove and install the flow regulating subplate assembly as shown in figure 2-48.

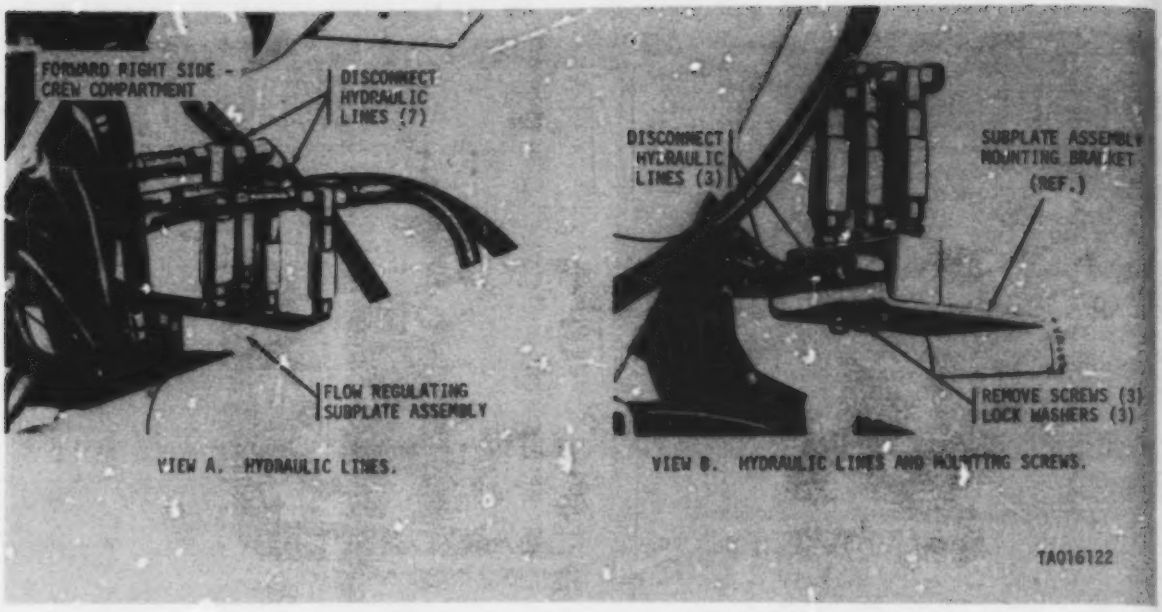

FORWARD RIGHT SIDE - CREW COMPARTMENT
DISCONNECT HYDRAULIC LINES (7)
FLOW REGULATING SUBPLATE ASSEMBLY
VIEW A. HYDRAULIC LINES.
DISCONNECT HYDRAULIC LINES (3)
SUBPLATE ASSEMBLY MOUNTING BRACKET (REF.)
REMOVE SCREWS (3) LOCK WASHERS (3)
VIEW B. HYDRAULIC LINES AND MOUNTING SCREWS.
TA016122

Figure 2-48. Flow regulating subplate assembly—removal and installation.

i. Boom Limit Pilot Valves. Prior to removal of the boom limit valves, remove deck grilles 6 and 20 (fig. 2-2). Remove and install the boom limit valves as shown in figure 2-49. Refer to TM 9-2350-256-20 for adjustment instructions.

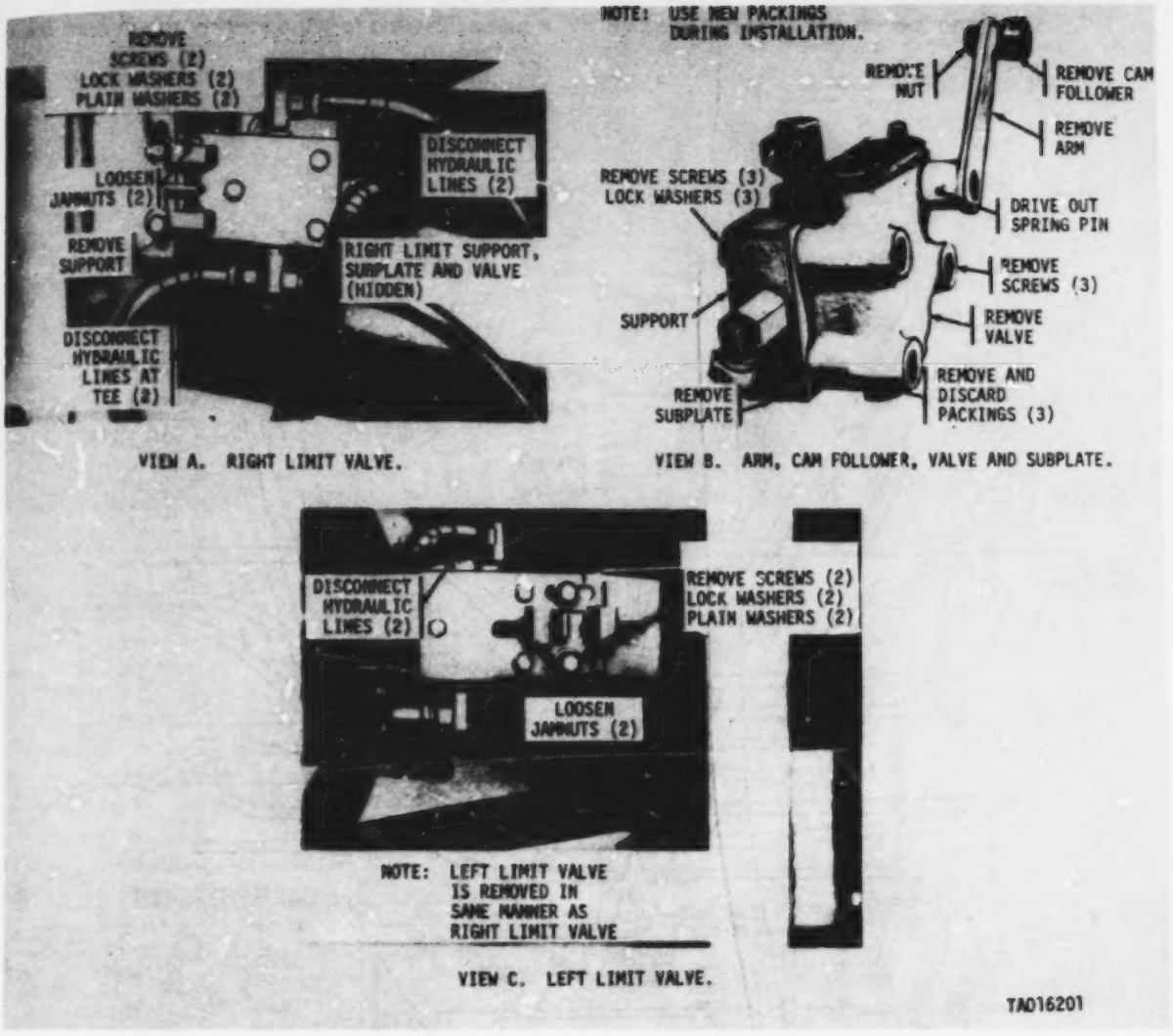
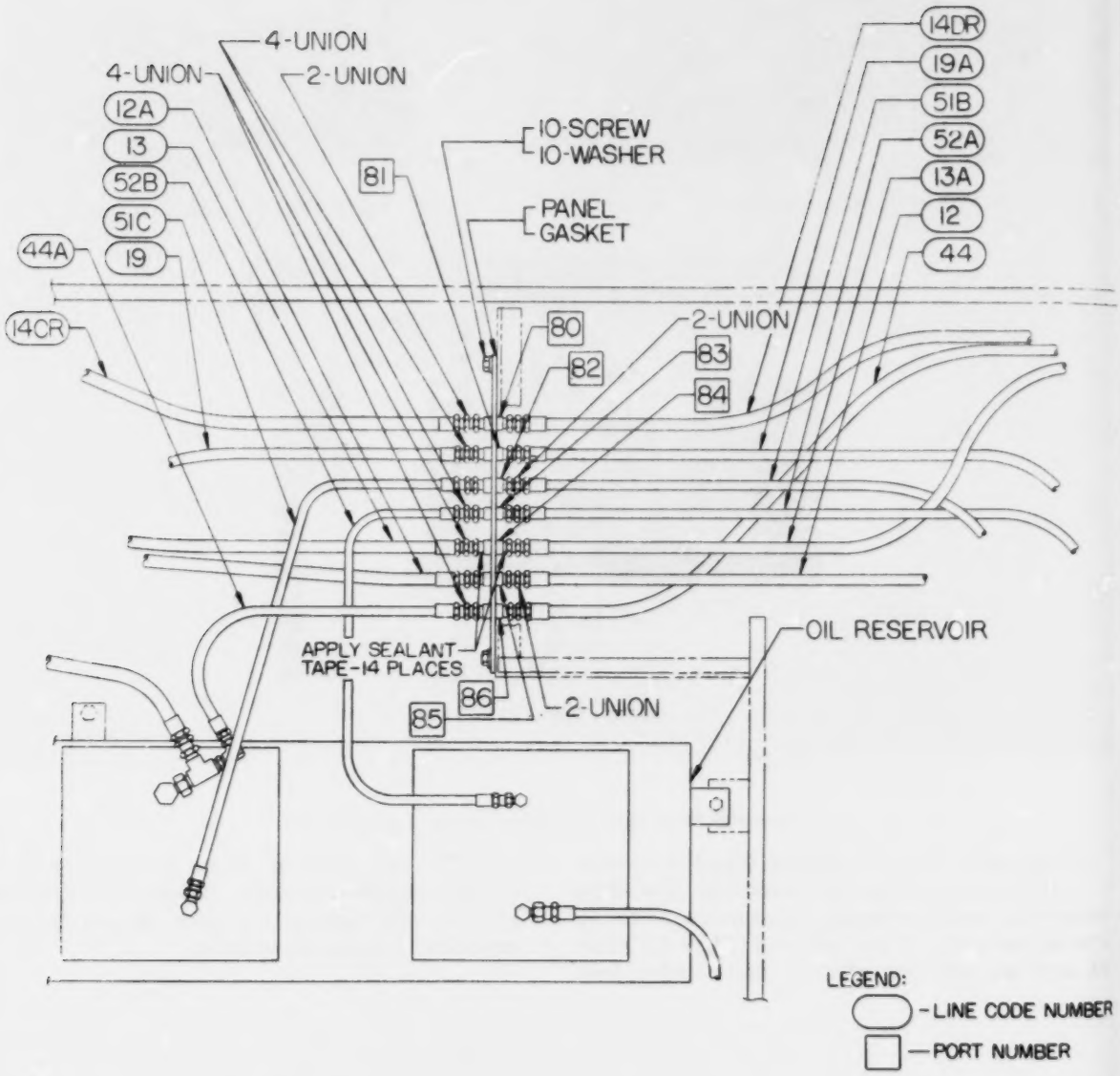

REMOVE SCREWS (2) LOCK WASHERS (2) PLAIN WASHERS (2)
DISCONNECT HYDRAULIC LINES (2)
LOOSEN JAMNUTS (2)
REMOVE SUPPORT
RIGHT LIMIT SUPPORT, SUBPLATE AND VALVE (HIDDEN)
DISCONNECT HYDRAULIC LINES AT TEE (2)
VIEW A. RIGHT LIMIT VALVE.
NOTE: USE NEW PACKINGS DURING INSTALLATION.
REMOVE NUT
REMOVE CAM FOLLOWER
REMOVE ARM
REMOVE SCREWS (3) LOCK WASHERS (3)
DRIVE OUT SPRING PIN
REMOVE SCREWS (3)
SUPPORT
REMOVE VALVE
REMOVE SUBPLATE
REMOVE AND DISCARD PACKINGS (3)
VIEW B. ARM, CAM FOLLOWER, VALVE AND SUBPLATE.
DISCONNECT HYDRAULIC LINES (2)
REMOVE SCREWS (2) LOCK WASHERS (2) PLAIN WASHERS (2)
LOOSEN JAMNUTS (2)
NOTE: LEFT LIMIT VALVE IS REMOVED IN SAME MANNER AS RIGHT LIMIT VALVE
VIEW C. LEFT LIMIT VALVE.
TA016201

Figure 2-49. Boom limit pilot valves—removal and installation.

j. Hydraulic Hose Connecting Panel Assembly.

(1) *Removal.* Prior to removing the hose connecting panel assembly, disconnect hydraulic lines on both sides of the bulkhead (TM 9-2350-256-20) and tag each line with the port number from which it was removed. Refer to figure 2-50 for location of lines and ports. Remove 10 screws and washers and remove the hose connecting panel assembly. Discard the gasket.



TA015993

Figure 2-50. Hydraulic hose connecting panel assembly, connecting lines and fittings—installation location.

(2) *Installation.* Install the hose connecting panel assembly in reverse order of removal, using a new gasket and being careful to reconnect the hydraulic lines at the correct ports.

CHAPTER 3

REPAIR OF RECOVERY VEHICLE, FULL TRACKED: MEDIUM, M88A1

Section I. REPAIR OF HULL ASSEMBLIES

3-1. Description

The hull and cab are constructed of cast armor and armor plate welded into a single unit. Padded seats are provided in the cab for the crew and passengers. Doors and hatches are located around the vehicle for crew access and stowage compartments.

3-2. Seals and Linings

a. General. Repair of the various rubber insulation seals and linings installed on the vehicle consists of replacing those that are worn.

b. Rubber Sealing Strips on Acetylene Compartment Door.

(1) Remove the old seal and discard. Clean the area thoroughly by scraping off old adhesive and then removing dirt, grease and other foreign matter with a wire brush.

(2) Apply fresh rubber base adhesive (NSN 8040-00-281-1972 or NSN 8040-00-843-3461) and wait until adhesive becomes slightly tacky.

(3) Press new seal (NSN 9390-00-247-2335) firmly into place and clean any excess adhesive from surface of seal.

(4) Allow adhesive to thoroughly dry before closing door.

c. Lining of Fire Extinguisher Bracket Arms. Refer to TM 9-2350-256-20 for removal and installation and for repair of the fire extinguisher bracket assembly. When replacing the lining of the arm assemblies, use the old lining as a pattern and cut to the same size. Set the rivet tangs below the lining surface so that the surface is smooth. Peen over properly to hold securely in place.

3-3. Pads

a. Rocket Ammunition Storage Box Pads. Repair of the sponge rubber strips in the ammunition storage box is the same as for the acetylene compartment door seals (para. 3-2*b*), except that the new strips are cut to the proper size from sheets. Use the old strip as a pattern and cut to the same size. Refer to paragraph 3-2 for repair instructions.

b. Vision Cupola Padding Assembly.

(1) *Disassembly.* Refer to TM 9-2350-256-20 for removal and installation. Disassemble the vision cupola padding assembly as shown in figure 3-1.

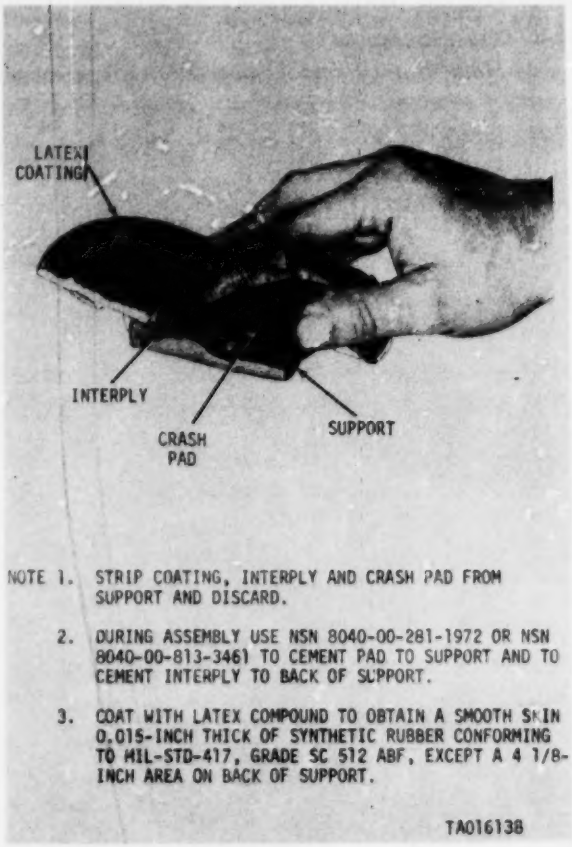

LATEX COATING
INTERPLY
CRASH PAD
SUPPORT
NOTE 1. STRIP COATING, INTERPLY AND CRASH PAD FROM SUPPORT AND DISCARD.
2. DURING ASSEMBLY USE NSN 8040-00-281-1972 OR NSN 8040-00-813-3461 TO CEMENT PAD TO SUPPORT AND TO CEMENT INTERPLY TO BACK OF SUPPORT.
3. COAT WITH LATEX COMPOUND TO OBTAIN A SMOOTH SKIN 0.015-INCH THICK OF SYNTHETIC RUBBER CONFORMING TO MIL-STD-417, GRADE SC 512 ABF, EXCEPT A 4 1/8-INCH AREA ON BACK OF SUPPORT.
TA016138

Figure 3-1. Vision cupola padding assembly—repair.

(2) *Cleaning.* Scrape dirt and adhesive from the support and clean with a wire brush. Clean with dry cleaning solvent or mineral spirits paint thinner and dry.

(3) *Inspection and Repair.* Inspect the support for cracks, distortion, breakage or other damage that would impair its use. If defective, replace entire padding assembly.

(4) *Assembly.* Assemble the vision cupola padding assembly in reverse order of disassembly.

Section II. REPAIR OF POWERPLANT

3-4. Description.

Refer to TM 9-2815-220-34 for description and operation of the Continental Model AVDS-1790-2DR engine. Refer to TM 9-2520-215-34 for description and operation of the Allison-GM Model XT-1410-4 cross-drive transmission.

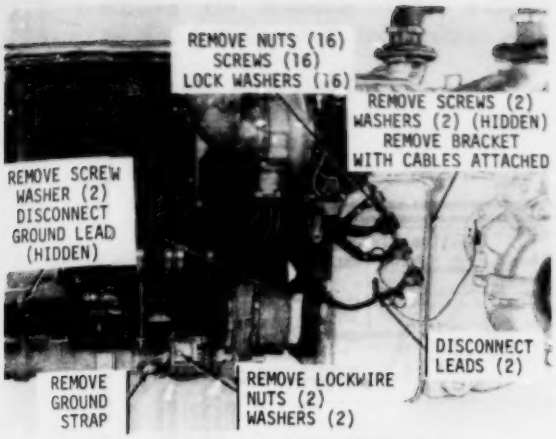
3-5. Removal.

Refer to TM 9-2350-256-20 for instructions on removing the powerplant from the vehicle.

3-6. Disassembly.

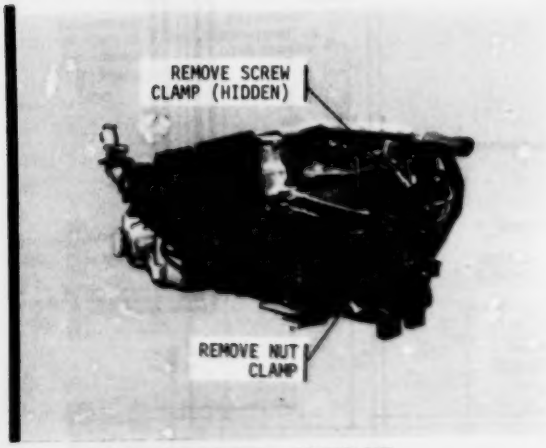
a. Main Engine and Transmission Separation. For instructions on separating the main engine from the transmission, refer to TM 9-2350-256-20. If just the transmission is to be repaired or replaced, it is not necessary to remove the wiring harness and accessories from the engine.

b. Wiring Harness and Accessories. Remove all accessory items necessary to work on the engine and transmission (TM 9-2350-256-20). Remove wiring harnesses and cables as shown in figure 3-2. Figure 3-3 shows the main engine wiring diagram.

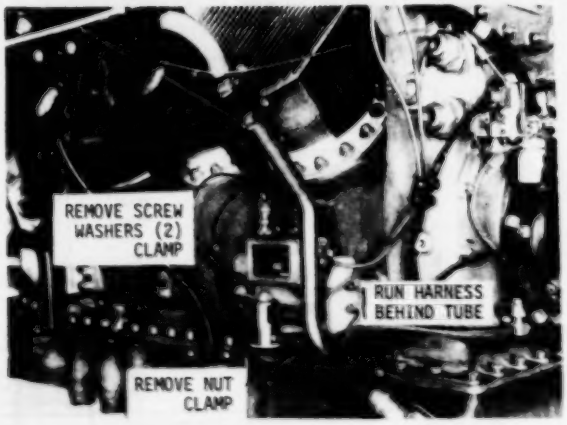


VIEW A. RIGHT SIDE REAR - POWERPLANT.

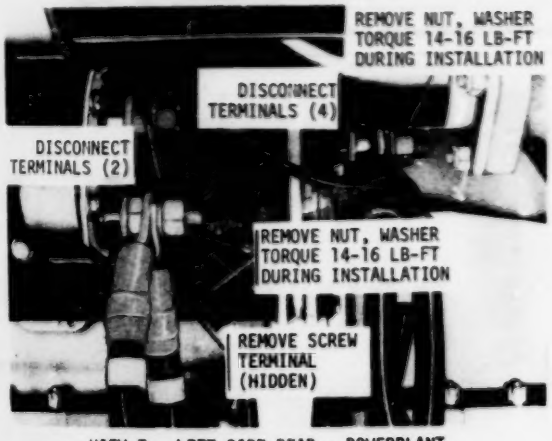
VIEW B. RIGHT FRONT - POWERPLANT.



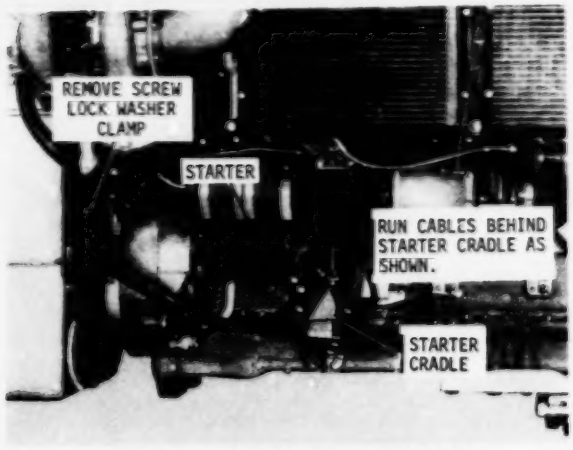
VIEW C. LEFT FRONT - POWERPLANT.



VIEW D. LEFT SIDE FRONT - POWERPLANT.



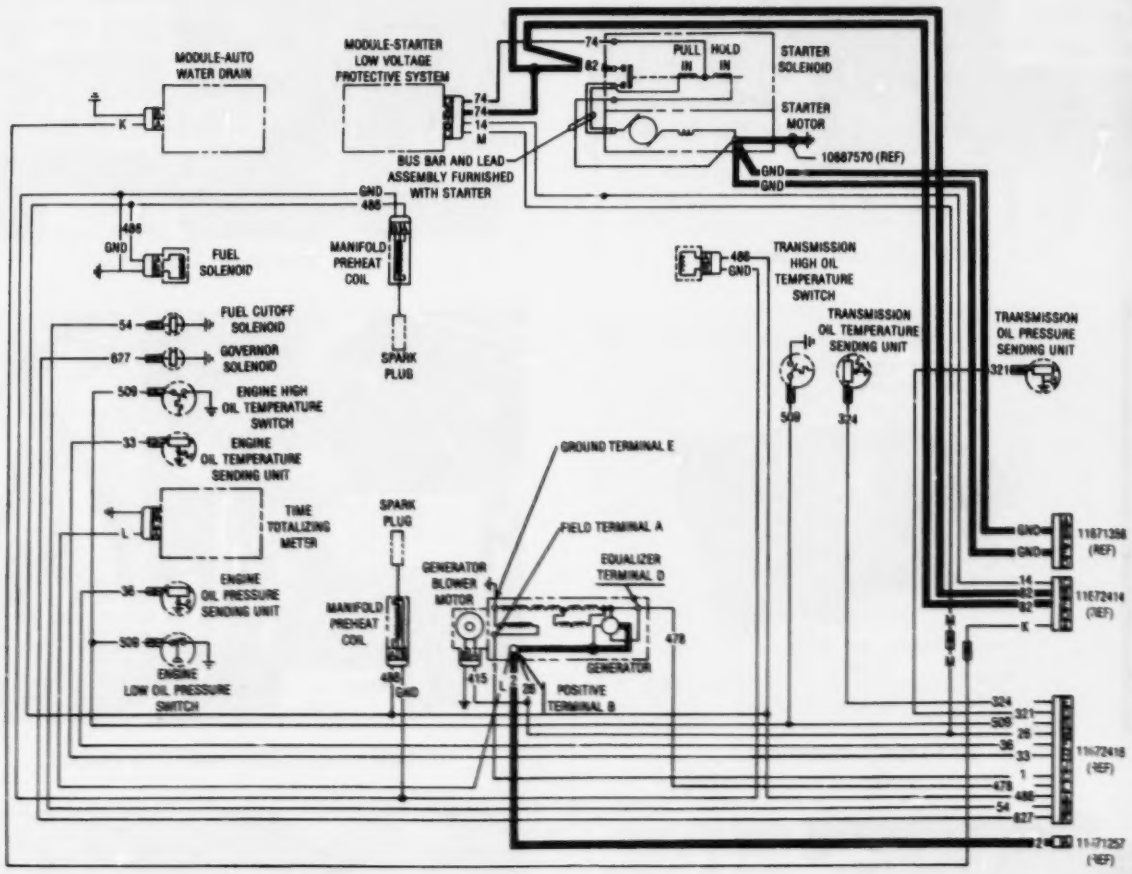
VIEW E. LEFT SIDE REAR - POWERPLANT.



VIEW F. LEFT SIDE REAR - POWERPLANT.

TA039267

Figure 3-2. Main engine wiring--removal and installation.



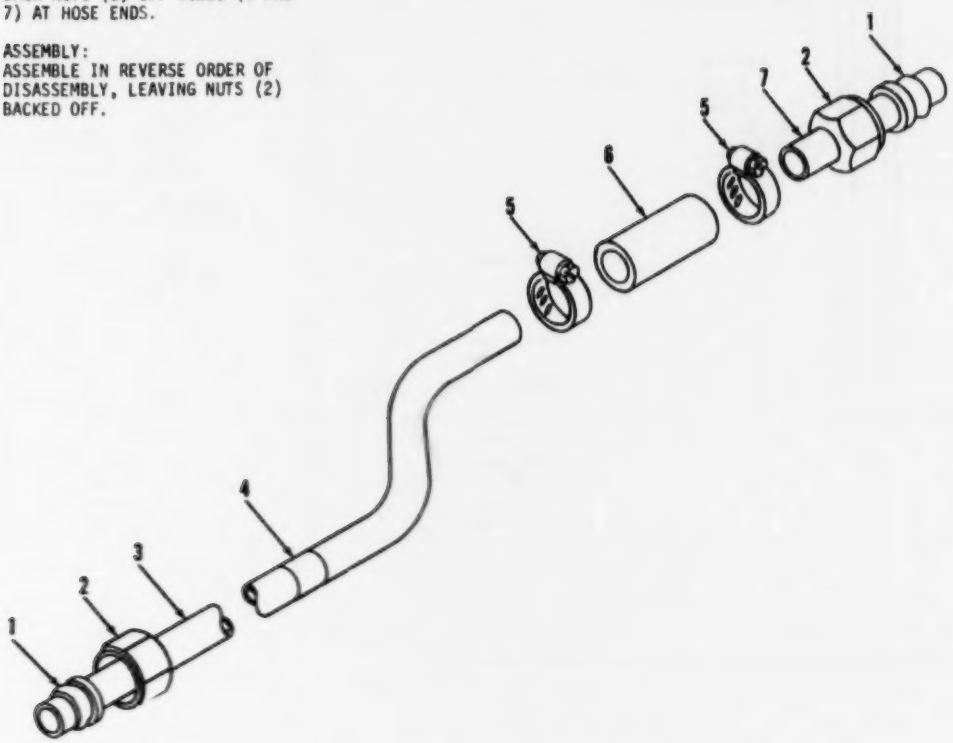
TA171403

Figure 3-3. Main engine wiring diagram.

c. Transmission Oil Breather Tube Assembly. Refer to TM 9-2350-256-20 for removal and installation instructions. Disassemble the oil breather tube assembly as shown in figure 3-4.

DISASSEMBLY:
REMOVE CLAMPS (5) AND HOSE (6).
BACK NUTS (2) OFF TUBES (3 AND 7) AT HOSE ENDS.

ASSEMBLY:
ASSEMBLE IN REVERSE ORDER OF DISASSEMBLY, LEAVING NUTS (2) BACKED OFF.



TA015995

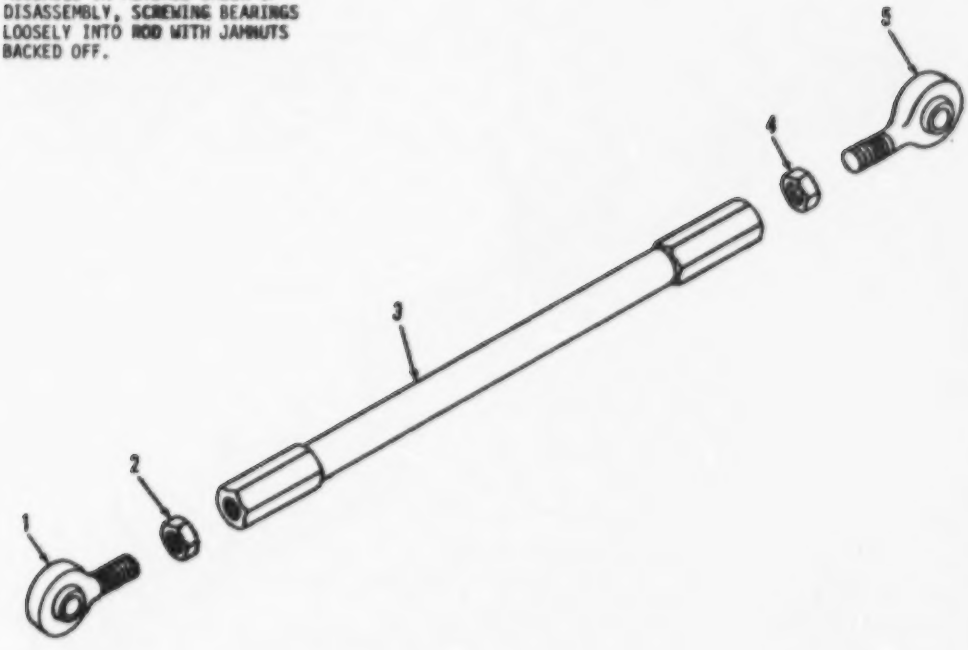
Figure 3-4. Transmission oil breather tube assembly—disassembly and assembly.

Legend for fig. 3-4:
1 Sleeve (2)
2 Nut (2)
3 Tube
4 Marker
5 Clamp
6 Hose
7 Tube

d. Transmission Lockup Control (Throttle) Linkage Rod Assembly. Refer to TM 9-2350-256-20 for removal and installation instructions. Disassemble the lockup control rod assembly as shown in figure 3-5.

DISASSEMBLY:
LOOSEN JAMNUTS (2 AND 4) AND REMOVE BEARINGS (1 AND 5) FROM ROD (3). REMOVE JAMNUTS FROM BEARINGS.

ASSEMBLY:
ASSEMBLE IN REVERSE ORDER OF DISASSEMBLY, SCREWING BEARINGS LOOSELY INTO ROD WITH JAMNUTS BACKED OFF.



TA015998

Figure 3-5. Transmission lockup control linkage rod assembly—disassembly and assembly.

Legend for fig. 3-5:
1 Bearing
2 Jamnut
3 Rod (with ends)
4 Jamnut
5 Bearing (left hand thread)

3-7. Cleaning and Inspection

a. Cleaning.

(1) Wash hoses and harnesses in a mild soap solution, rinse with clean water and dry with compressed air.

(2) Clean all metal parts with drycleaning solvent or mineral spirits paint thinner. Use a wire brush where necessary and dry with compressed air.

b. Inspection.

(1) Inspect engine, transmission, wiring harness and all accessories for breaks, leaks, damage, excessive wear, missing parts or unserviceable condition.

(2) Check the following for the transmission oil breather tube (fig. 3-4) and lockup control linkage rod (fig. 3-5):

(*a*) Rods and rod ends for cracks or distortion.

(*b*) Leading edge of sleeve (1, fig. 3-4) should be at least 1/8 inch from end of tube and close to or touching tube.

(*c*) Back of sleeve (1, fig. 3-4) should be in contact with tube.

(*d*) Sleeve (1, fig. 3-4) for evidence of wear and distortion.

(*e*) Hose (6, fig. 3-4) for fraying, cracks or excessive wear.

(*f*) Clamps, connecting and pivot parts for excessive wear.

(*g*) Threaded parts for cross threading and nicks.

3-8. Repair or Replacement

a. Refer to TM 9-2815-220-34 for engine repair or TM 9-2520-215-34 for transmission repair. If the engine or transmission is to be replaced, record the action on DA Form 2408-10, Equipment Component Register.

b. Refer to TM 9-2350-256-20 for instructions on repairing the main engine wiring harness and cables.

c. Refer to TM 9-2350-256-20 for instructions on repairing the main engine and transmission accessories removed for powerplant inspection or replacement.

d. Replace all defective parts on the transmission oil breather tube and lockup control linkage rod assemblies. If any one of the rods or sleeves (fig. 3-4 and 3-5) is defective, replace the entire assembly.

3-9. Assembly

a. Rejoin the main engine and transmission (TM 9-2350-256-20).

b. Assemble all items removed from the powerplant. Install the accessories and wiring harness and cables in reverse order of removal.

3-10. Installation

Refer to TM 9-2350-256-20 for instructions on installing the powerplant in the vehicle.

Section III. REPAIR OF FUEL TANKS

3-11. Description

The fuel tanks are of a welded steel construction. The left rear tank contains the filler cap and filter assembly. The right and forward tanks contain liquid quantity sending units. The electric fuel pump is housed in the forward tank.

3-12. Removal

(Refer to paragraphs 2-18, 2-19 and 2-44 for instructions on removing the left rear, right rear and forward fuel tanks respectively.

3-13. Disassembly

a. Left Rear Fuel Tank. Remove the filler tube and strainer (TM 9-2350-256-20) if they were not removed prior to removal of the tank.

b. Right Rear Fuel Tank. Remove the transmitter (TM 9-2350-256-20) if it was not removed prior to removal of the tank.

c. Forward Fuel Tank. Remove the transmitter and electric fuel pump (TM 9-2350-256-20) if they were not removed prior to removal of the tank. Unscrew the magnetic drain plug from the bottom, clean it of all particles, inspect for thread damage and replace on tank prior to cleaning tank.

3-14. Cleaning

a. General. When a tank is repaired for leaks it is necessary to clean, inspect and test it. Coordinate the following cleaning procedures with the inspection and tests in paragraph 3-15. Clean other tank components with drycleaning solvent or mineral spirits paint thinner and dry with compressed air.

b. Procedure.

(1) Slush tank interior with methylene chloride (pure) or chemical cleaner as specified in TB 750-1047, Elimination of Combustibles From Interiors of Metal or Plastic Gasoline and Diesel Fuel Tanks, to remove residual fuel, dirt, sediment and foreign matter.

(2) Drain and air dry. Reclean magnetic drain plug if necessary.

3-15. Inspection, Test and Repair

a. Inspect tank for cleanliness. Repeat cleaning procedures (para. 3-14) if necessary.

b. Inspect tank for any obvious cracks or open seams. Inspect mounting brackets, mounts and cushions for cracks or breaks. Weld assembly and components as required.

c. Inspect tank inlets and outlets for thread damage and repair with a thread chaser as required.

d. Test for leaks as follows:

(1) Close all openings with temporary plugs or other closures and apply 3-4 psi internal air pressure.

(2) Apply soapy water solution, consisting of liquid soap diluted with 20-40% water, to all exterior surfaces of tank and inspect for air bubble formation.

(3) Mark location of any bubble formation, rinse and dry tank and weld the marked areas (TM 9-237).

e. Repeat step *d.*

3-16. Assembly

The electric pump and other fittings and accessories may be assembled on the tanks either before or after installation of the tanks in the vehicle. Refer to paragraph 3-13. Refer to TM 9-2350-256-20 for installation instructions.

Section IV. REPAIR OF ELECTRIC FUEL PUMP

3-17. Description

The fuel pump is located in the forward fuel tank sump cavity and is a centrifugal pusher-type pump designed for submerged operation. It operates by power from a 24-volt dc motor contained in the pump assembly.

3-18. Removal.

Remove and install the fuel pump according to instructions found in TM 9-2350-256-20.

3-19. Disassembly.

Disassemble the electric fuel pump as shown in figure 3-6.

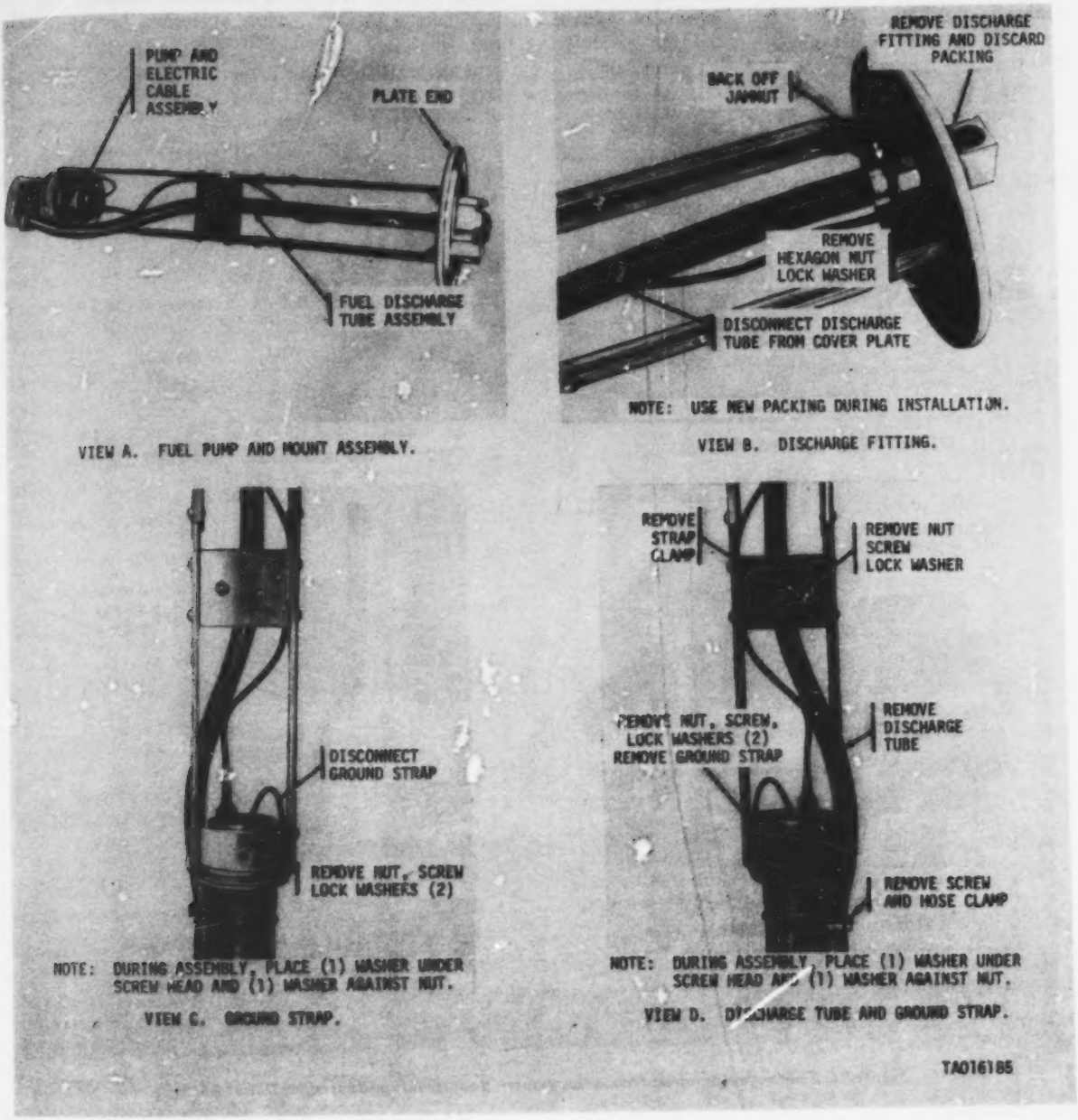

PUMP AND ELECTRIC CABLE ASSEMBLY
PLATE END
FUEL DISCHARGE TUBE ASSEMBLY
VIEW A. FUEL PUMP AND MOUNT ASSEMBLY.
REMOVE DISCHARGE FITTING AND DISCARD PACKING
BACK OFF JAMNUT
REMOVE HEXAGON NUT LOCK WASHER
DISCONNECT DISCHARGE TUBE FROM COVER PLATE
NOTE: USE NEW PACKING DURING INSTALLATION.
VIEW B. DISCHARGE FITTING.
DISCONNECT GROUND STRAP
REMOVE NUT, SCREW LOCK WASHERS (2)
NOTE: DURING ASSEMBLY, PLACE (1) WASHER UNDER SCREW HEAD AND (1) WASHER AGAINST NUT.
VIEW C. GROUND STRAP.
REMOVE STRAP CLAMP
REMOVE NUT SCREW LOCK WASHER
REMOVE NUT, SCREW, LOCK WASHERS (2) REMOVE GROUND STRAP
REMOVE DISCHARGE TUBE
REMOVE SCREW AND HOSE CLAMP
NOTE: DURING ASSEMBLY, PLACE (1) WASHER UNDER SCREW HEAD AND (1) WASHER AGAINST NUT.
VIEW D. DISCHARGE TUBE AND GROUND STRAP.
TA016185

Figure 3-6. Electric fuel pump and mount assembly—disassembly and assembly (Sheet 1 of 2).

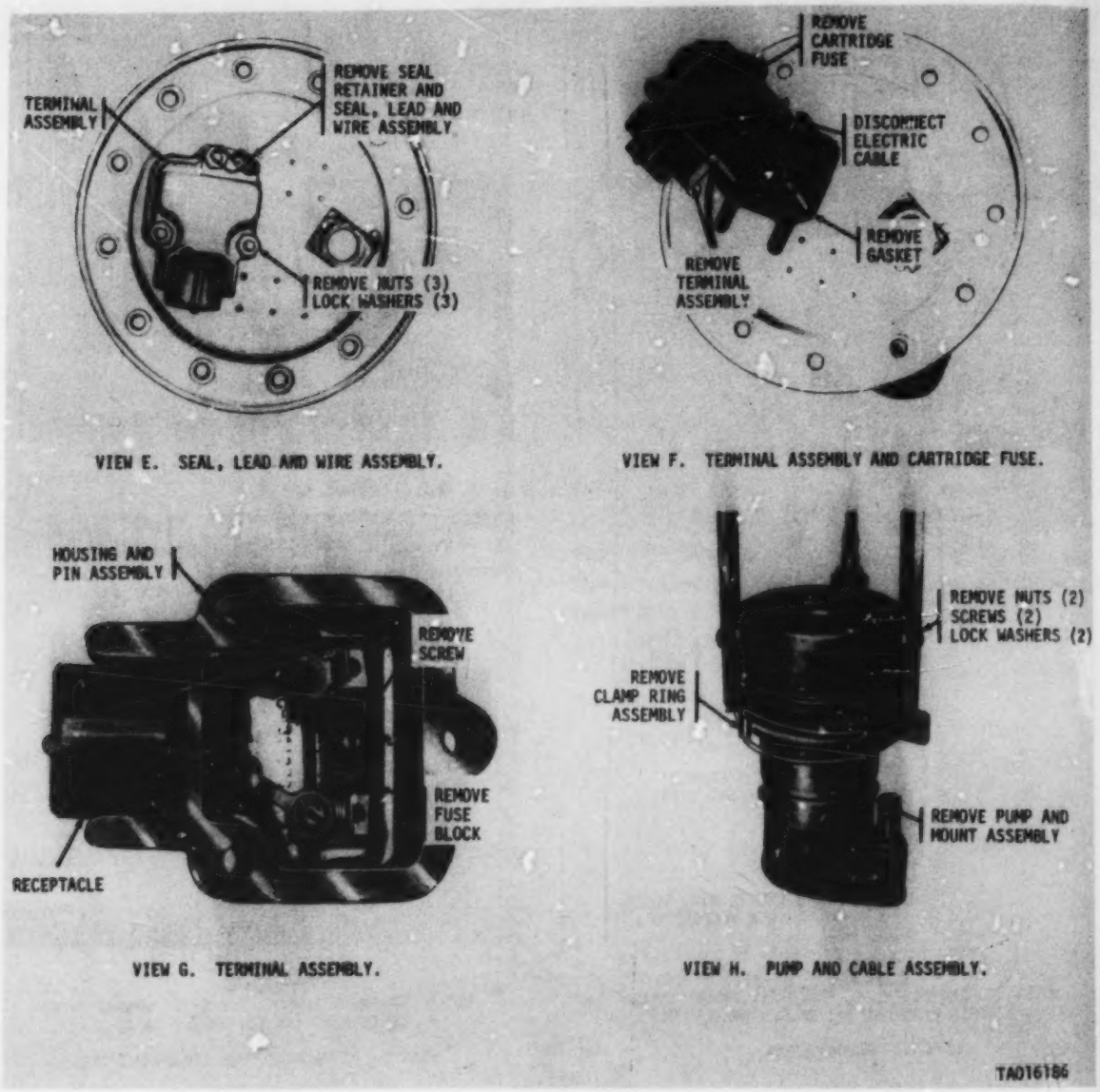

TERMINAL ASSEMBLY
REMOVE SEAL RETAINER AND SEAL, LEAD AND WIRE ASSEMBLY
REMOVE NUTS (3) LOCK WASHERS (3)
VIEW E. SEAL, LEAD AND WIRE ASSEMBLY.
REMOVE CARTRIDGE FUSE
DISCONNECT ELECTRIC CABLE
REMOVE GASKET
REMOVE TERMINAL ASSEMBLY
VIEW F. TERMINAL ASSEMBLY AND CARTRIDGE FUSE.
HOUSING AND PIN ASSEMBLY
REMOVE SCREW
REMOVE FUSE BLOCK
RECEPTACLE
VIEW G. TERMINAL ASSEMBLY.
REMOVE NUTS (2) SCREWS (2) LOCK WASHERS (2)
REMOVE CLAMP RING ASSEMBLY
REMOVE PUMP AND MOUNT ASSEMBLY
VIEW H. PUMP AND CABLE ASSEMBLY.
TA016186

Figure 3-6. Electric fuel pump and mount assembly--disassembly and assembly (Sheet 2 of 2).

3-20 Cleaning.

After disassembly and before inspection, clean metal parts in clean diesel fuel or drycleaning solvent. Clean tube in mild soap solution. Carefully blow out and dry each part with compressed air.

3-21. Inspection and Repair

a. Inspection.

(1) Inspect pump for cracks, distortion and warpage.

(2) Inspect cable for cuts, damage and continuity.

(3) Inspect tube assembly for cracks and other evidence of excessive wear in tube and for damage to swivel end.

(4) Check continuity of ground cable and inspect for cuts or other damage.

(5) Inspect welded and support parts for cracks, distortion and breakage.

(6) Inspect threaded parts for nicks, cross threading and excessive wear.

(7) Inspect polarizing pin, terminal pin assembly, connector housing and pin assembly and fuse block for nicks, cracks, distortion and other damage that would impair their use.

(8) Inspect other terminal assembly components for tears, cracks, hardening and other damage that would impair their use.

b. Repair.

(1) Replace pump and electric cable assembly if continuity check of cable shows it to be grounded or if there is any evidence of damage that would impair its use.

(2) Repair dents or distortions. Weld cracks and breaks in metal parts where practical. Replace defective parts if badly damaged.

(3) Repair threaded parts with a thread chaser if practical or replace defective parts.

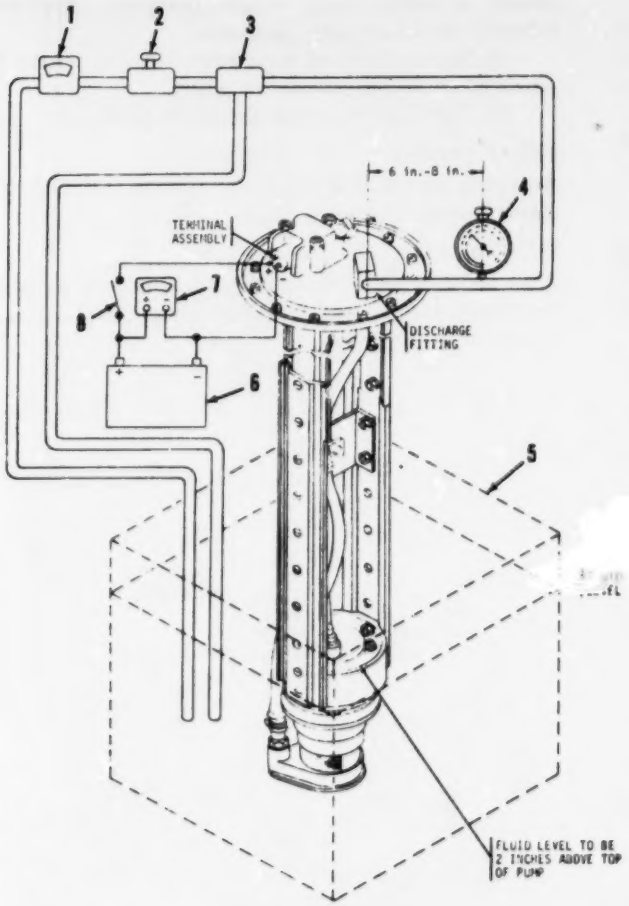
(4) Replace any other defective parts.

3-22. Assembly

Assemble electric fuel pump and mount assembly in reverse order of disassembly.

3-23. Tests

Prior to installation in the vehicle, test the electric fuel pump and mount assembly for performance as shown in figure 3-7.



WARNING

VAPOR CAN EXPLODE FROM ELECTRIC ARC. DO NOT OPERATE PUMP BY CONNECTING OR DISCONNECTING CLIPS. USE A SWITCH (8) IN THE LINE.

LEGEND

EQUIPMENT REQUIRED:	DESCRIPTION:
1. FLOWMETER	0-10 GPH ± 2% OF SCALE READING.
2. ADJUSTABLE FLOW REGULATOR	0-10 PSI.
3. RELIEF VALVE	10 PSI.
4. PRESSURE GAGE (TAP SHALL BE IN A 0.5 INCH I.D. DISCHARGE LINE, 6-8 INCHES FROM PUMP DISCHARGE FITTING)	0-10 PSI ± 2% OF SCALE READING.
[illegible] SERVOIR	TO SUIT (FLUID LEVEL MUST BE MINIMUM OF 2 INCHES ABOVE PUMP).
6. ADJUSTABLE DC POWER SOURCE	OUTPUT CAPABILITY 0-28 VDC @ 5 AMPERES.
7. DC VOLTMETER	MUST MEASURE 17.5 - 28 VDC TO WITHIN AN ACCURACY OF 0.25%.
8. SPST TOGGLE SWITCH	MS39061-1 (24 VDC, 24 AMP).
TEST FLUID	FUEL VV-F-800.
HOSE, PIPING AND FITTINGS	TO SUIT.

NOTE

TO DETERMINE POLARITY OF THE TERMINAL ASSEMBLY PINS, FACE THE PUMP AND MOUNT ASSEMBLY SO THAT THE DISCHARGE FITTING IS TO THE RIGHT AND THE TERMINAL TO THE LEFT WITH THE LONG CENTER (POLARIZING) PIN AT THE TOP OF THE TERMINAL AND THE SCREW AT THE BOTTOM. THE POSITIVE (HOT) PIN IS ON THE LEFT SIDE OF THE TERMINAL AND THE NEGATIVE (GROUND) PIN IS ON THE RIGHT SIDE.

TEST AFTER REASSEMBLY OF FUEL PUMP

1. ASSEMBLE TEST EQUIPMENT TO PUMP WITH SWITCH (8) OPEN AND SUBMERGE PUMP IN TEST FLUID (FUEL VV-F-800) SO THAT TEST FLUID COVERS PUMP BY AT LEAST 2 INCHES.
2. ADJUST POWER SUPPLY FOR 27.5 ± 0.1 VDC. CLOSE SWITCH (8) AND READJUST POWER SUPPLY IF NECESSARY.
3. OPERATE PUMP AT 27.5 ± 0.1 VDC. RATED FLOW SHOULD BE 220 ± 9 GPH (3.67 ± 0.15 GPM) AT 3.75 PSI.
4. REPEAT STEP 2 FOR AN 18 + 0.1 VDC POWER SUPPLY.
5. OPERATE PUMP AT 18 ± 0.1 VDC. RATED FLOW SHOULD BE 80 ± 3 GPH (1.33 + .05 GPM) AT 2.50 PSI.

TA015997

Figure 3-7. Electric fuel pump test.

Section V. REPAIR OF PURGE PUMP

3-24. Description

The purge pump is used to pump air from the fuel lines and to operate the engine manifold heaters for cold weather starting.

3-25. Removal

Refer to TM 9-2350-256-20 for instructions on removing and installing the purge pump.

3-26. Disassembly

Disassemble the pump as shown in figure 3-8.

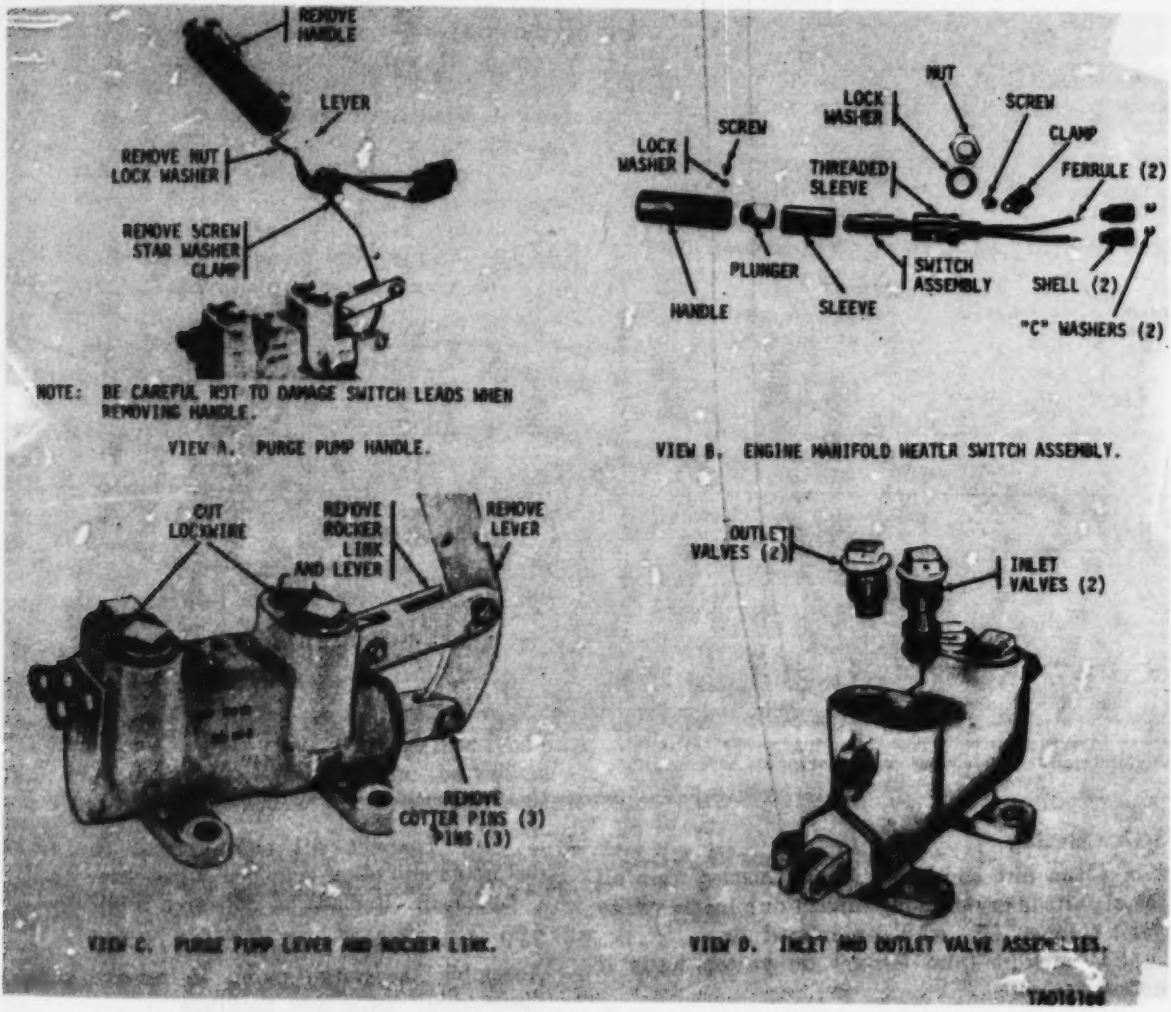


Figure 3-8. Purge pump—disassembly and assembly (Sheet 1 of 2).

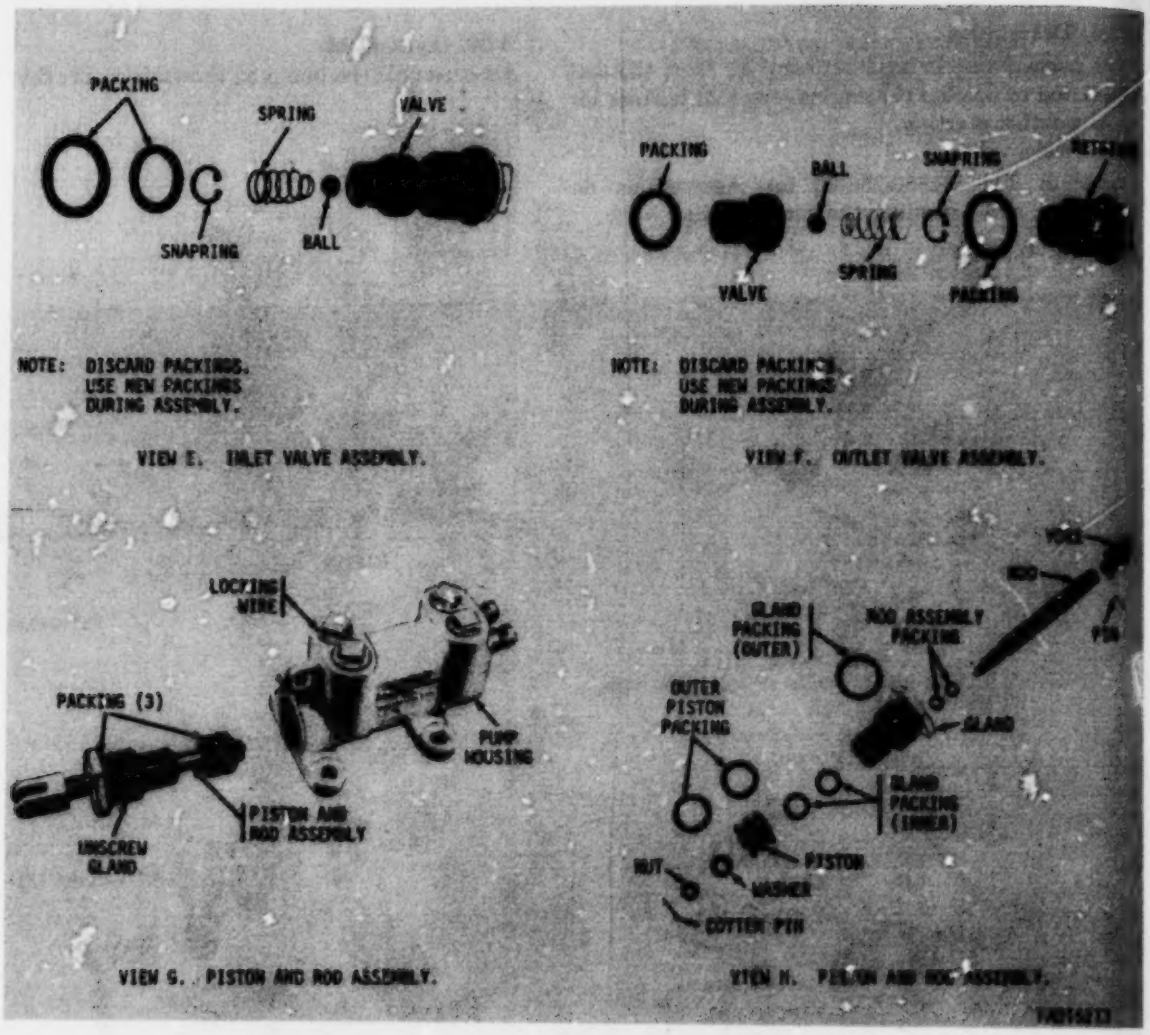


Figure 3-8. Purge pump—disassembly and assembly (Sheet 2 of 2).

3-27. Cleaning

a. Clean dirt and other foreign matter from all metal parts in dry-cleaning solvent or mineral spirits paint thinner. Dry with compressed air.

b. Clean dirt from ferrules on switch leads if necessary.

3-28. Inspection and Repair

a. Inspection.

(1) Inspect switch leads for cuts or other damage.

(2) Check switch for electrical continuity and switching action.

(3) Inspect threaded parts for stripping, cross threading and other evidence of excessive wear.

(4) Inspect all components for cracks, distortion and other evidence of excessive wear.

b. Repair. Replace all defective components.

3-29. Assembly

Assemble the purge pump in reverse order of disassembly using new packings.

3-30. Tests

Install the purge pump in vehicle (TM 9-2350-256-20) and test by using normal operating procedures as described in TM 9-2350-256-10.

Section VI. REPAIR OF PERSONNEL HEATER

3-31. Description

a. The personnel heater is mounted vertically in the crew compartment on the right rear cab wall. The personnel heater control box is mounted on the left cab wall to the rear of the driver's seat. The heater burns a mixture of diesel fuel and air in the sealed heat exchanger. Air for combustion is supplied from outside of the vehicle.

b. Fuel from the electrical fuel pump and fuel filter enters the heat exchanger and is ignited within by an electric igniter. An electric heating element preheats the fuel, insuring a quick start. An overheat switch and an electric time-delay cartridge are provided as safety switches. An air fan flows air through the heater for circulation in the crew compartment.

c. When the control switch is placed in the start position, the heater igniter circuit, fuel pump, blower motor, fuel shutoff solenoid, and fuel preheater are energized. At the end of the igniter (preheat) cycle, which takes a maximum time of 4 minutes, the flame switch automatically transfers the heater to a run condition, and power is then removed from the igniter circuit and is applied to the fuel pump, blower motor, fuel shutoff solenoid, fuel preheater, indicator lamp and the HI-LO switch. At this time the heater will operate in either a high or low heat condition depending upon which position has been selected on the HI-LO switch.

d. Refer to TM 9-2540-205-24&P for a detailed description of the personnel heater components, together with the heater wiring diagram.

3-32. Removal

a. Refer to TM 9-2350-256-20 for instructions on removal of the personnel heater from the vehicle.

b. Bleed all fuel lines after completing any repair to the fuel system.

c. After installation, the following steps should be performed before attempting to start the heater (figure 3-9):

(1) Open all heater fuel system shutoff valves.

(2) Disconnect the control cable harness at the control head connector on the heater.

(3) Disconnect the fuel line connection at the heater fuel inlet fitting.

(4) Provide a suitable container at the outlet of the fuel line to catch fuel.

(5) Depress the heater control box RUN-OFF-START switch to the START position to activate the electric fuel pump. Continue pump operation until a clear steady flow of fuel is obtained. This operation is important as it will purge the fuel delivery system of all air contamination that will be present in a new system or a system that has been opened for repairs.

(6) Reconnect the fuel line at the heater being careful to prevent any contamination from entering the system.

(7) Reconnect the control cable harness to the heater control head.

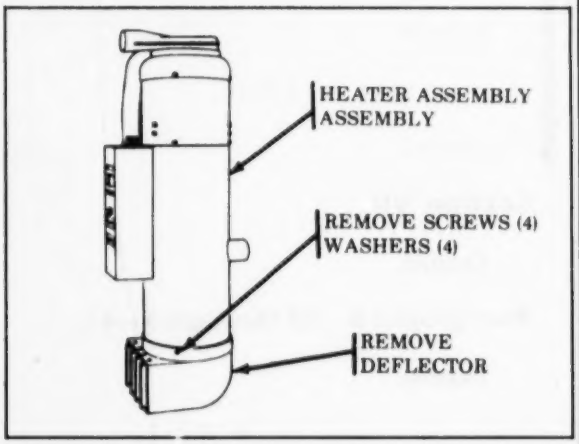


Figure 3-9. Personnel heater assembly - disassembly and assembly.

3-33. Disassembly

Deleted.

TA171784

Figures 3-10.2 through 3-10.5. Deleted.

3-34. Cleaning

Deleted.

3-35 Inspection and Repair

Deleted.

Figures 3-10.6 and 3-10.7.

Deleted.

3-36. Reassembly and Installation

Deleted.

Figures 3-10.8 through 3-10.13.

Deleted.

3-36.1 Testing

Deleted.

Figures 3-10.14 and 3-10.15.

Deleted.

Section VII.

Deleted.

Paragraphs 3—37 through 3—41.

Deleted.

Figure 3-10.2. Deleted.

(a) Remove the guard assembly (16) by releasing the two fasteners attaching the guard to the heater housing (28). Cut the two cable assembly straps (37).

(b) Remove two flag terminals on one end of the ignition control (25). Remove two motor leads marked 2 and 4 by removing two screws (42) on the terminal strip of the electrical inlet assembly (36).

(c) Remove four screws (2) that secure the blower assembly (1) to the heater housing (28).

(d) Feed motor leads and voltage limiter lead through grommet (33) and slide blower assembly from the heater.

(e) Refer to figure 3-10.3 and disassemble the blower assembly as follows:

Legend for figure 3-10.3:

1 Screw
2 Air inlet louver
3 Blower housing assembly
4 Screw
5 Voltage limiter assembly
6 Ventilation blower wheel assembly
7 Motor
8 Bracket
9 Screw
10 Secondary blower cover assembly
11 Nut
12 Combustion blower wheel assembly
13 Diode mounting assembly
14 Nut
15 Nut
16 Cable assembly strap
17 Cable assembly
18 Screw
19 Screw
20 Spacer sleeve
21 Washer
22 Resistor
23 Screw
24 Motor power lead

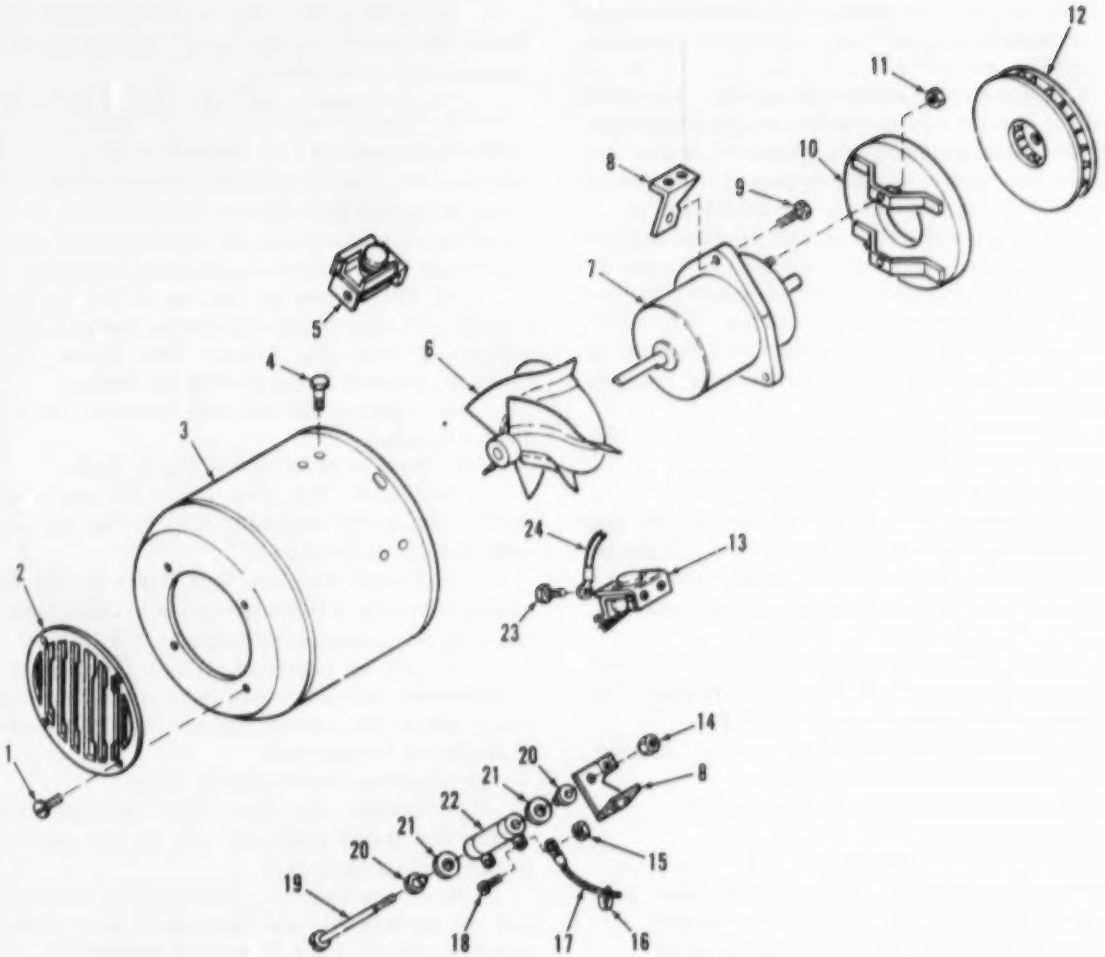


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Figure 3-10.3. Blower assembly—disassembly and assembly.

1 Remove the four screws (1) which secure the air inlet louver (2) to blower housing assembly (3), and remove the louver.

2 Remove the setscrew that secures the combustion blower wheel (12) to the end of the motor shaft; remove the blower wheel. Remove the two nuts (11) and remove the secondary blower cover assembly (10) from studs of the motor.

3 Clip and remove the cable assembly strap (16). Remove the three screws (9) which secure the flange of the motor (7) to the motor mounting brackets (8).

4 Remove six screws (4) securing the motor mounting brackets (8) to the mounting flange and blower housing assembly (3). Remove two of the brackets; the resistor and cable assembly (items 14 through 22) remain attached to the third bracket.

5 Remove the four screws (4) securing the diode mounting assembly (13) and voltage limiter (5) to the mounting flange and blower housing assembly. Pull out the connected motor (7), diode mounting assembly, voltage limiter, and resistor to remove them from the flange and blower housing assembly.

6 Loosen the setscrew in the collar of the ventilation blower wheel assembly (6) and pull the blower wheel from the motor shaft.

7. Remove the screw which secures the diode mounting assembly ground lead to the motor housing. Remove the screw (23) which secures the motor power lead to the diode mounting assembly; disconnect the lead.

8 Disconnect the cable assembly (17) and diode mounting assembly lead from the resistor (22) by removing the screws (18) and nuts (15).

9 Remove nut (14) from screw (19) that secures resistor (22) from screw (19).

(2) *Electrical inlet assembly (fig. 3-10.2)*

NOTE

It is rarely necessary to remove the electrical inlet assembly unless the assembly itself is damaged, or the heater is being completed overhauled. It is not necessary to completely remove the electrical inlet assembly to remove the burner or heat exchanger.

(a) Remove the guard assembly (16) by releasing the two fasteners attaching the guard to the heater housing (28).

(b) Cut the two cable assembly straps (37) which bundle the cable assemblies (38, 40, 43) together. Remove screws (42) as necessary to disconnect the wires from the terminal strip.

(c) Remove the igniter ground from the terminal (31) on the heater housing. Remove the nut (29) from the grounding stud on the heater housing and pull off the inlet assembly grounding lead, the lockwashers (30 and 32), and the terminal (31).

(d) Remove lead from connector D on receptacle to terminal on flame detector switch (21) by removing screw (20) in the switch terminal.

(e) Loosen two fasteners and remove electrical inlet assembly.

(3) *Igniter (fig. 3-10.2).*

(a) Loosen the two Dzus fasteners which secure the guard assembly (16) to the top of the heater; remove the guard.

(b) Disconnect electrical cable at the heater.

(c) Loosen the two Dzus fasteners which secure the electrical inlet assembly (36) to the heater housing (28). Pull the inlet assembly up, disengage it from the igniter leads and the fuel tube (5) and swing it out of the way without disconnecting any wires or removing the cable from the plug-in connector.

(d) Push down on the top of the igniter (9), rotate it 1/8 turn counterclockwise, and pull it out to remove it from the heater. The igniter can be removed without disconnecting the leads.

(e) Remove the seal (35) from the top of the heater housing.

(4) *Flame detector switch (fig. 3-10.2).*

(a) Loosen the two Dzus fasteners which secure the guard assembly (16) to the top of the heater; remove the guard.

(b) Check that the four wires to the flame detector switch (21) are labeled, and disconnect the wires by removing the four screws (20).

(c) Use an open-end wrench to unscrew the compression nut (22) which secures the flame detector switch to the heat exchanger (15). Pull the switch straight out to remove it.

(5) *Overheat switch (fig. 3-10.2).*

(a) Loosen the two Dzus fasteners which secure the guard assembly (16) to the top of the heater; remove the guard.

(b) Check that the two wires to terminals 9 and 30 are labeled, and disconnect them from the overheat switch (24) by removing screws (19).

(c) Remove the two screws (18) which secure the overheat switch to the top of the heater and remove the switch.

(6) *Fuel control valve.*

(a) Bleeding. The fuel lines and fuel control valve body must be bled whenever the fuel system runs dry, or if service is performed on the fuel lines or fuel filter. Bleed as follows:

1 Bleed the fuel system up to the heater by loosening the fuel connection where it enters the valve body. Let the fuel drip out until it is free of bubbles, then reconnect the fuel line.

2 Slide a piece of 3/16 ID tubing over the

nipple on the end of the bleed valve stem (37, fig. 3-10.4) on the fuel control valve. Open the bleed valve with a 1/4-inch wrench and turn the control switch to START.

3 Let the system bleed until the fuel is free of air bubbles. Tighten the bleed valve and shut off the heater.

NOTE

The fuel must flow past the shut-off solenoid before it reaches the bleed valve. Therefore, the shut-off solenoid must be energized to bleed the valve body.

(b) Removal (fig. 3-10.2).

1 Loosen the two Dzus fasteners which secure the guard assembly (16) to the top of the heater, and remove the guard.

2 Disconnect the fuel supply line from the IN port on the fuel control valve (26), and plug the line to prevent excessive siphoning of fuel. Unscrew the conpression nut (6) and disconnect the fuel tube (5) from the control valve outlet elbow.

3 Cut the two cable assembly straps (37) which bundle the wires together. Remove the control valve leads 3 and 5 from the terminal strip on the electrical inlet assembly (36); disconnect lead 30 from the overheat switch (24).

4 Remove the two screws (27) on one side of the control valve mounting bracket, and loosen the third screw. Disengage the fuel tube from the elbow and pull off the fuel control valve.

5 Refer to figure 3-10.4 and disassemble the fuel control valve as follows:

Legend for fig. 3-14.4:

1 Screw
2 Mounting bracket
3 Screw
4 Outer plate
5 Insulator plate
6 Packing
7 Plate
8 Plate
9 Packing
10 Coil assembly
11 Elbow
12 Insulator
13 Sleeve
14 Wire
15 Screw
16 Cable assembly
17 Thermostat
18 Valve body
19 Valve core
20 Screw
21 Adjusting screw
22 Spring
23 Diaphragm cap
24 Diaphragm assembly
25 Packing
26 Valve spring
27 Gasket
28 Sleeve and core assembly
29 Solenoid cup
30 Washer
31 Coil assembly
32 Screw
33 Screw
34 Plunger assembly
35 Plunger
36 Valve seal
37 Bleed valve stem
38 Inlet screen

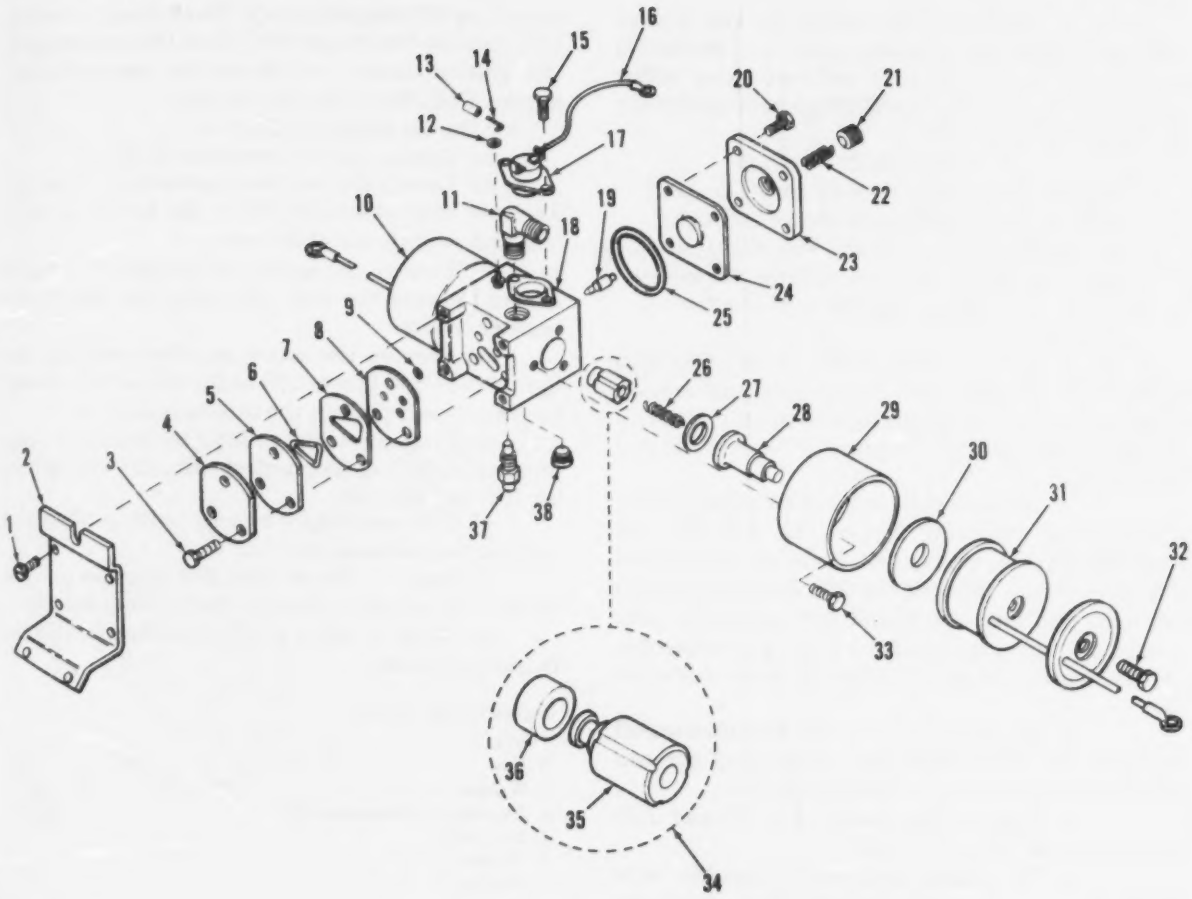

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Figure 3-10.4. Fuel control valve-disassembly and assembly.

WARNING

Do not attempt to disassembly or repair fuel control valve unless facilities are available to conduct the flow test described in paragraph 3-36*b*(1)(*h*). An improperly calibrated valve can cause excessive fuel to build up in and around the heater assembly, creating a fire hazard.

a. Remove mounting bracket (2) by removing four screws (1) that secure it to the valve body (18).

b. Remove three screws (3) and remove the outer plate (4), insulator plate (5), preformed packing (6), 3-hole plate (7), and restriction orifice plate (8). Pull three small preformed packings (9) out of recesses in valve body.

CAUTION

Handle the orifice plate with care. Do not drop it. Do not force any object through the orifice plate openings. The slightest distortion in the plate or orifices will interfere with proper operation of the fuel control valve.

c. Remove adjusting screw (21) and spring (22). Remove four screws (20) and remove diaphragm cap (23), diaphragm assembly (24) and preformed packing (25). Unscrew valve core (19) and remove it.

d. Remove restriction solenoid and valve assembly by removing screw (32). Pull out coil assembly (31) and washer (30). Remove three screws (33) in bottom of solenoid cup (29). Remove solenoid cup and pull out sleeve and core assembly (28), gasket (27), valve spring (26), and plunger assembly (34). Remove valve seal (36) from bottom of plunger (35).

e. Repeat d above to disassemble shut-off solenoid and valve assembly, except pull out coil assembly (10) instead of coil assembly (31).

f. Remove bleed valve stem (37) and inlet screen (38) and valve body (18).

g. To remove thermostat, unsolder wire (14) from the electrical terminal on the valve body. Slide off the insulating sleeve (13) and the insulator (12). Remove two screws (15) that secure the thermostat (17) to valve body, and remove the thermostat. If the thermostat is being replaced, unsolder the cable assembly (16) from terminal on thermostat.

h. Unscrew elbow (11) to remove it from valve body (18).

(7) Ignition control (fig. 3-10.2).

(a) Loosen the two Dzus fasteners which secure the guard assembly (16) to the top of the heater; remove the guard.

(b) Cut the two cable assembly straps (37) which bundle the wires together. Disconnect the igniter lead and the voltage limiter lead from one end of the ignition control (25). If necessary to provide access to the wires, remove the fuel control valve ((6)(*b*) above).

(c) Disconnect the ignition control lead from one of the NO contacts on the flame detector switch (21). Remove the two screws (17) on the outer edge of the ignition control, and loosen the two remaining screws. Pull off the ignition control.

(8) Burner assembly (fig. 3-2).

(a) Remove blower assembly ((1) above).

(b) Loosen the two fasteners which secure the electrical inlet assembly (36) to the heater housing (28), and swing it out of the way.

(c) Remove the igniter (9) as described in (3) above. Remove the seal (35) from the top of the heater housing.

(d) Remove the screw (4) which secures the igniter tube and bracket (8) to the secondary blower housing (3) and pull out the tube to remove it.

(e) Disconnect fuel tube (5) by loosening compression nuts (6) at fuel control valve (26) and at burner (10); pull out tube.

(f) Slide secondary blower housing (3) out of heat exchanger assembly (15).

(g) Remove six screws (39) that secure the burner (10) to heat exchanger, and pull out burner.

(h) Refer to figure 3-10.5 and disassemble the burner as follows:

Legend for fig. 3-10.5:

1 Nut
2 Nut
3 Washer
4 Plate and bushing assembly
5 Yarn wick
6 Washer
7 Washer
8 Washer
9 Fuel vaporizer
10 Washer
11 Washer
12 Fuel vaporizer shield
13 Screw
14 Burner cup and stud assembly

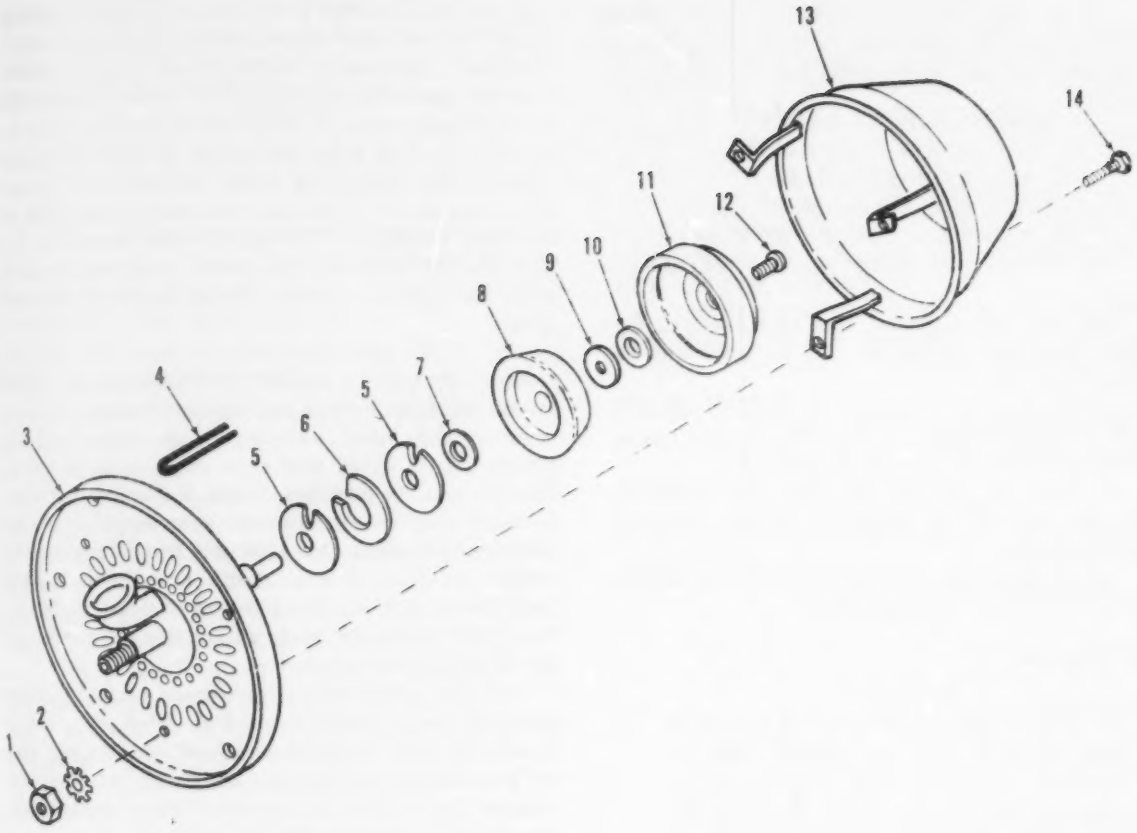

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Figure 3-10.5. Burner assembly—disassembly and assembly.

1 Remove six nuts (1 and 2) and flat washers (3) from studs on burner cup and stud assembly (14). Remove burner cup from plate and bushing assembly (6).

2 Remove screw (13) and pull off fuel vaporizer shield (12), and washers (10 and 11). Detach yarn wick (5) from wich support in plate and bushing assembly (4). Remove fuel vaporizer (9), retaining washer (8), notched washer (6), slotted washer (7), and second notched washer (6).

(9) Heat exchanger (fig. 3-10.2).

(a) If the heat exchanger (15) is being removed for heater overhaul, remove the following components to facilitate cleaning of the heater housing:

1 Ignition control ((7) above.)

2 Fuel control valve ((6) above).

3 Overheat switch ((5) above).

4 Electrical inlet assembly ((2) above).

(b) Remove burner assembly ((8) above.

(c) Remove the flame detector switch ((4) above).

(d) Disconnect ground lead assembly (12, fig. 3-10.2) from heat exchanger (15) by removing attaching screw (11).

(e) Remove four screws (34) holding together the seam of the heater housing (28). Spread heater housing and slide out heat exchanger (15).

(f) Remove the ground lead (12) from the heater housing (28) by removing the nut (14) and lockwasher (13).

(g) If the grommet (33) is worn or damaged, remove it from the heater housing.

3-34. Cleaning

WARNING

Be careful when using cleaning solutions and solvents. Do not expose skin to solvents or inhale their vapors. Many cleaning agents are toxic, and contact with them or their vapors may cause illness or death. Wear protective clothing and devices, and ensure adequate ventilation while using cleaning agents.

a. Clean dirt and foreign matter from all exterior metal parts with drycleaning solvent or mineral spirits paint thinner and dry with compressed air.

b. Clean air inlet hose and rubber seals in a mild soap solution, rinse and dry.

c. Clean the fuel filter in the inlet line to prevent the collection of moisture and the formation of ice during cold weather. Follow the manufacturer's recommendations.

CAUTION

Do not attempt to operate the heater without a fuel filter, or with the fuel filter element removed. The filter element prevents the entry of dirt, ice crystals, wax, and other contaminants which can easily plug the tiny orifices in the fuel control valve.

d. Clean blower housing, ventilating blower wheel, combustion blower wheel, secondary blower cover assembly, motor mounting brackets, and exterior of motor with a cloth dampened with cleaning solvent.

e. Clean the burner and heat exchanger. The burner has been designed to eliminate excessive buildup of carbon and other deposits within the combustion chamber. However, buildup can occur under unusual operating conditions or if other components are malfunctioning. A minor carbon buildup may be removed by operating the heater at near maximum voltabe and restricting outlet airflow to maintain the temperature of the heat exchanger at or near an overheat condition. The operate the heater on LO long enough to permit the excess combustion air to burn out soot and carbon. Repeat this cycle several times.

(1) If this procedure faills to clean the heat exchanger enough to restore performance, or if the burner or heat exchanger require further service, remove the heat exchanger as described in paragraph 3-33*c*(9), and then remove as much of this deposit as possible, using a flexible scraper. Remove combustion residue from inside heat exchanger by soaking this assembly in a 20 percent by weight solution of ammonium acetate at a temperature of 180°F., for a period of 5 to 10 hours. Flush out exchanger with water after cleaning, and dry with compressed air.

(2) For units which have been burning other types of fuel, such as diesel fuel, JP-4, etc., water should be used to flush the heat exchanger. Use compressed air to dry the inside of the heat exchanger and remove all traces of water before heat exchanger is reinstalled in the heater.

f. Wipe all non-metallic parts of fuel control valve with a clean, dry cloth. Clean metallic parts except the orifice plate with a cloth dampened with cleaning solvent. Take care not to saturate electrical windings or insulation with solvent. Dry all parts thoroughly. Clean orifice plate holes and orifice plate with solvent and compressed air. Inspect for cleanliness with a magnifier.

CAUTION

Do not force any tool or object through the orifice plate openings. The slightest distortion in these calibrated holes will change the factory calibrated rate of fuel flow.

g. To clean the flame detector switch, refer to

paragraph 3-33c(4) and remove this switch from heater.

(1) Next, remove the adjusting screw and pivot the microswitch on its bracket to provide access to the ceramic rod. Invert the flame detector switch assembly and remove the ceramic rod.

(2) With the switch assembly inverted, rap on the side of the tube with a screwdriver blade to jar loose oxides and dirt. Continue rapping until no more oxides fall out of the tube.

h. To clean the overheat switch, refer to paragraph 3-33c(5) and remove this switch.

(1) Clean the points by sliding a piece of clean white bond paper between them. Use a soft bristle brush to brush off loose dust and dirt.

CAUTION

Do not use sandpaper, emery cloth, or other abrasive material to clean switch points.

i. Clean all electrical components and nonmetallic parts with a clean cloth. Remove greasy and gummy deposits with cleaning solvent. Clean all metallic parts with a cloth dampened with solvent.

3-35. Inspection and Repair

a. Air Control Assembly, Deflector, and Exterior Components.

(1) *Inspection*

(a) Inspect air inlet hose for fraying, cracks and other signs of excessive wear.

(b) Inspect heater for any damage that would impair its use.

(c) Inspect fuel filter for leaks, cracks, and other damage that would impair its use.

(d) Inspect copper tubing for cracks, dents, obstruction and other signs of excessive wear.

(e) Inspect seals for cracks, tears, hardening and other signs of excessive wear.

(f) Inspect threaded parts for nicks and cross threading.

(g) Inspect saddles on bulkhead for cracks, breakage, and other signs of excessive wear.

(h) Inspect all metal parts for cracks distortion, open weld seams and other damage that would impair its use.

(2) *Repair.*

(a) Repair damaged threads with a thread chaser, if practical, or replace threaded parts that are defective.

(b) Weld open seams and other damaged areas of metal parts if practical (TM 9-237). Replace defective metal parts not repairable by welding.

(c) Replace all other defective parts.

b. Personnel Heater Components.

(1) *Blower assembly (fig. 3-10.3).*

(a) Inspect blower wheels for cracks, distortion, and bent or broken blades. Replace if damaged.

(b) Inspect all wiring for broken or burned insulation, damaged terminals, or broken wires. Replace damaged wiring.

(c) Test the resistor for continuity, and inspect the ceramic insulator for cracks, burned areas and other damage. Replace the resistor if it is open circuited or damaged.

(d) Inspect the voltage limiter for cracks, distortion, signs of overheated components, or other damage. Replace if defective. Test the voltage limiter as follows:

1. The following test equipment is required:

a. 24 volt dc power supply, 5 ampere minimum capacity.

b. Two on-off switches.

c. Two resistors, 50 watt minimum, one 6 ohm and one 10 ohm.

d. Two 0 to 30 volt dc voltmeters.

NOTE

The voltage limiter can be tested while it is still installed in the assembled heater. Just make sure that the heater housing is connected to the same ground as the meters and resistor, and perform the test as described below.

2. Connect test equipment as shown in test schematic, figure 3-10.6.

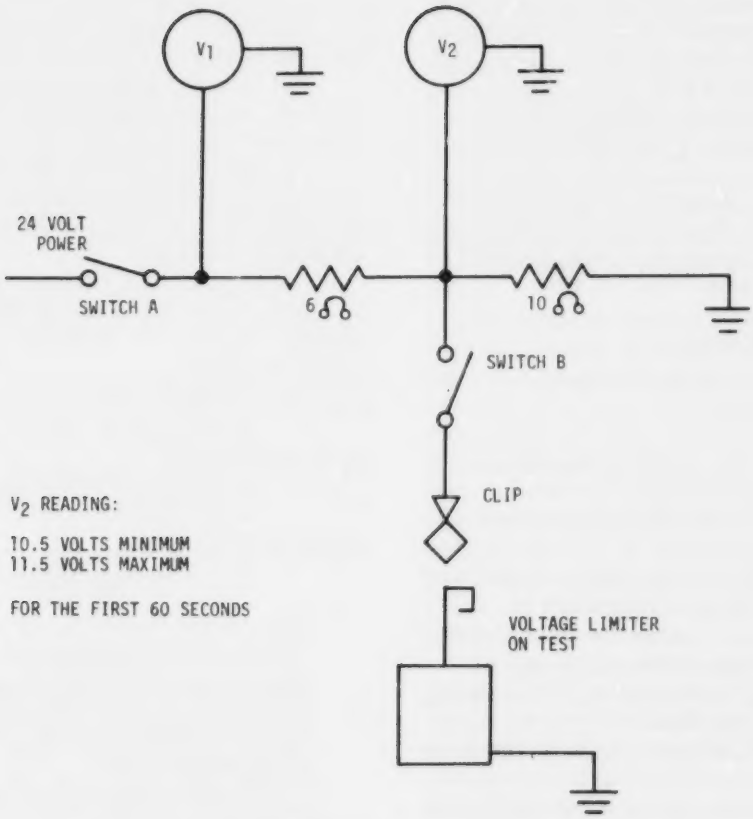

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Figure 3-10.6. Test schematic for voltage limiter.

3. Energize the power supply and turn on switch A. Adjust power supply to read 24 volts at V_1.

4. Ground the voltage limiter on test through its mounting bracket. Clip switch B to the flag terminal.

5. Turn on switch B and observe the volage on meter V_2. The voltage must be 10.5 volts minimum to 11.5 volts maximum.

NOTE

The voltage limiter must act instantly to control the voltage at meter V_2 and must remain steady at the control point. If the unit is left energized for longer than 60 seconds, a further decline in control voltage may be observed. This is not cause for rejection.

6. If the voltage does not fall within specifications, or if control is erratic or intermitent, voltage limiter must be replaced.

7. Turn off power supply and switches A and B. Remove voltage limiter from test equipment and install voltage limiter at reassembly.

(e) Test diode assembly as follows:

1. Identify the three diode assembly leads:

a. Lead marked 4 with connects to terminal 4 on terminal strip mounted on electrical inlet assembly.

b. Lead marked GRD which connects to motor housing to ground the diode assembly.

c. Unmarked lead which connects to one side of resistor.

2. Use an ohmmeter or ohms test function of a multitester. Touch one test probe to the terminal on the diode assembly. Touch the other test probe to the No. 4 lead terminal. Note the meter reading. Reverse the polarity of the test probes and note the meter reading. Resistance must be very high with one polarity and zero or very low with the other polarity.

3. Repeat this test with the unmarked lead. Results must be the same.

4. To test the ground diode, touch one test lead to the mounting leg of the diode assembly. Touch the other test probe to the GRD lead terminal. Note the meter reading. Reverse the polarity of the test probes and note the meter reading. Resistance must be very high with one polarity and zero or very low with the other polarity.

5. If readings are high or low in both directions for one or more of the diode assembly leads, replace the entire diode assembly. Diodes are not serviceable individually.

(2) Electrical inlet assembly (fig. 2-10.2). Inspect the electrical inlet assembly (36) for cracks, damaged connector, chipped or broken terminal strip, missing screws, and defective fasteners; replace a defective electrical inlet assembly.

(3) Igniter (fig. 3-10.2)

(a) With the igniter leads still connected to the ignition control and ground, reconnect the electrical cable to the receptacle and disconnect the fuel shutoff solenoid lead from terminal 30 on the overheat switch (to shut off fuel and avoid flooding the burner), then move the control switch to START and hold it until igniter element glows.

CAUTION

If the igniter has been removed from the heater it must be tested at 10 volts or less. Voltage in excess of 10 volts will destroy the igniter in a short time.

(b) Carefully examine the glowing igniter. An igniter which has hot spots, uneven coil spacing, and hot and cool coils, has deteriorated significantly from its origiaal condition and should be replaced.

(c) Ignition wick inspection.

1. With the igniter removed, look into the igniter tube and inspect the condition of the ignition wick (5, fig. 3-10.5) using a flashlight if necessary. The wick should be dry, unbroken, and white or nearly white. The strands should be about 1/16 inch thick.

2. If the strands are thin or broken, remove the burner assembly as described in paragraph 3-33c(8) and repair or replace the burner.

3. If the wick is wet, the burner is flooded. Disconnect the shutoff solenoid lead at terminal 30 on the overheat switch. Reinstall the igniter and hold the control switch in the START position for several minutes. A white, smoke-like fuel vapor will flow from the exhaust until the heater lights. When the heater lights, reconnect the shut-off solenoid lead to terminal 30.

(4) Flame detector switch (fig. 3-10.7).

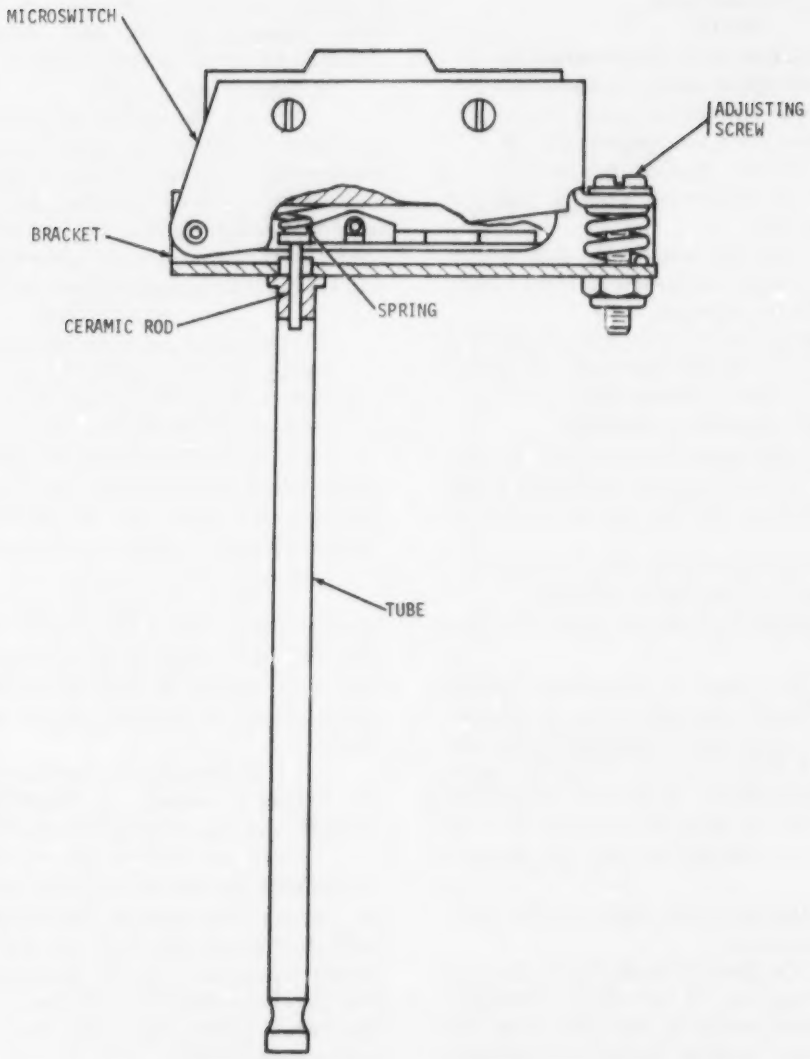

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Figure 3-10.7. Flame detector switch—showing components.

(a) Inspect the flame detector switch for cracks, heat distortion of the sensor tube, damaged terminals, and other visible damage. Clean, test, and adjust the flame detector switch as described below.

(b) Remove the adjusting screw and pivot the microswitch on its bracket to provide access to the ceramic rod. Invert the flame detector switch assembly and remove the ceramic rod.

(c) With the switch assembly inverted, rap on the side of the tube with a screwdriver blade to jar loose oxides and dirt. Continue rapping until no more oxides fall out of the tube.

(d) If the operation of the microswitch is questionable, test it for continuity. With the microswitch folded back, there must be continuity across the NC contacts until the actuator on the bottom of the switch is depressed; then there must be continuity across the NO contacts.

NOTE

When the flame detector switch is assembled and properly adjusted, the ceramic rod depresses the actuator to close the NO contacts. When the switch is at room temperature, there must be continuity across the NO contacts.

(5) Overheat switch (fig. 3-10.2). Inspect the contact points for burning, pitting, scratches, and other damage. Replace the overheat switch if the points are defective.

WARNING

Do not attempt to bend the blade or the contact arm. Do not change the setting of the adjustment screw.

(6) Fuel Control Valve (fig. 3-10.4).

(a) Clean fuel control valve parts as instructed in paragraph 3-34*f*.

(b) Inspect electrical parts for cracks, burned windings or leads, signs of overheating, and other damage; replace damaged parts.

(c) Check the fit of the plunger assembly (34) in the sleeve and core assembly (28). It must slide freely without excessive play. Check the sealing end of the plunger for scoring or damage; replace damaged parts.

(d) Inspect the valve body for rough or scored seating surfaces, damaged threads, cracks, or other damage; replace if defective. If there are no visible defects, check the heating element in the valve body as follows:

1 Test equipment required:

a. 24-volt power supply, 10 ampere minimum capacity.

b. Momentary contact switch.

c. 0 to 10 ampere ammeter.

2 Connect the power supply ground lead to the valve body. Connect the ammeter between the switch and the electrical terminal on the valve body. Connect power to the other side of the switch.

3 Close the momentary contact switch for a few seconds. Current as measured by the ammeter must be between 3.7 and 4.7 amps.

CAUTION

Do not apply current for longer than five seconds. If more than one check is required, allow 10 minutes cooling time between tests.

4 If heating element is being tested with the thermostat still connected, and if current draw is less than 3.7 amps, the solder joint may be defective. Repair it and retest. If it still fails, replace the fuel control valve as an assembly.

5 If amperage is greater than 4.7 amps, the heater element is shorted. The fuel control valve must be replaced as an assembly.

(e) Check the electrical continuity through the solenoid coil assemblies (31). Continuity must exist.

(f) Check the thermostat (17) for cracks, loose or damaged terminals, and distortion. The thermostat must close when temperature is reduced to between 43° and 57°F. It must open when temperature rises to between 65° and 75°F. If thermostat operation is questionable, it can be checked using a multimeter set to the ohms function, while chilling the thermostat with ice. Do not immerse in fluids. Body temperature can be used to provide enought heat to warm it to above 75°F. to check the opening point. Replace a defective thermostat.

(g) Inspect all other parts for cracks, distortion, corrosion. and other damage; replace damaged parts.

(7) Ignition control (fig. 3-10.2).

Inspect the ignition control assembly (25) for cracks, loose or damaged terminals, or other damage. Check for overheating or breaks in the electrical continuity path. Replace if defective.

(8) Burner assembly (fig. 3-10.4).

(a) If the heater has been operation for 400 hours or more since it was new or since the last burner replacement, it is recommended that the complete burner assembly be replaced. After this amount of use, distortion and erosion of the burner cup and the fuel vaporizer shield usually make replacement of the burner advisable to ensure efficient combustion and maximum heat output.

(b) Inspect the burner cup and stud assembly (14) and fuel vaporizer shield (12) for cracks, distorsion, and erosion. Replace the complete burner as an assembly if the cup or shield is defective.

(c) Inspect the plate and bushing assembly (4) for cracks, loose fuel feed bushing or igniter pocket, distortion, erosion of holes, and other damage.

Replace the complete burner as an assembly if the plate and bushing assembly is defective.

(9) Heat exchanger (fig. 3-10.2).

(a) Inspect the heat exchanger (15) for leaks, cracks, and carbon deposits. The interior of a unit which has been burning leaded gasoline will contain a deposit of lead by-products. Clean the heat exchanger as instructed in paragraph 3-34*e*.

(b) Check for warping of inner passages, or bulging of the heater plate. Replace the heat exchanger if warping or bulging is excessive, or if any part is burned through.

(c) Small cracks may be repaired by welding, provided they are accessible and the heat exchanger is otherwise in good condition. Do not attempt to repair large cracks, or to straighten a deformed heat exchanger.

WARNING

Carefully inspect the heat exchanger, and repair or replace it if damaged. Exhaust gases are directed through the heat exchanger. These gases contain carbon monoxide, a colorless, odorless, deadly poisonous gas. Cracks or holes in the heat exchanger permit the exhaust gases to enter the heated compartment. This can result in the serious illness or death of personnel in the compartment. Never take chances with a defective heat exchanger.

(d) When welding cracks in the heat exchanger, Type 310 weld rod is preferred, although Type 349, 321, or 347 may be used. Before welding, it is *very important* to clean *all* combustion deposits away from the area to be welded, since deposits in the exchanger can contaminate the weld to such an extent that a tight weld is almost impossible. Keep weld beads as small as possible, preferably not over 1/8 inch.

(10) Miscellaneous heater parts (fig. 3-10.2).

(a) Inspect the guard assembly (16) for cracks, dents, distortion, loose or defective fasteners, and other damage; replace a damaged guard assembly.

(b) Inspect the secondary blower housing (3) for cracks, distortion, loose weldments, and other damage; replace damaged parts.

(c) Inspect the heater housing assembly (28) for cracks, dents, distortion, missing weld nuts, broken studs, broken weldments, and other damage; replace a damaged housing.

3-36. Reassembly and Installation

a. Reassembly of Air Control Assembly. Refer to figure 3-10.1 and reassemble the air control assembly.

b. Personnel Heater Components.

(1) *Fuel control valve reassembly* (fig. 3-10.4).

(a) Install the elbow (11) on the valve body (18), and position it as shown in figure 3-10.8).

(b) If the thermostat (17, fig. 3-10.4) was removed, position it on the valve body and secure with two screws (15). Install the wire (14), making sure the insulator (12) and insulating sleeve (13) are in place before soldering the wire to the heater and thermostat terminals. Solder the cable assembly (16) to the other thermostat terminal.

(c) Install seal (36) on plunger (35) and insert valve spring (26) in the plunger assembly. Insert assembled spring and plunger into sleeve and core assembly (28). Position gasket (27) and sleeve and core assembly (28) on valve body, and install solenoid cup (29) with three screws (33) to retain part. Repeat to install plunger assembly (34) on other side.

(d) Screw valve core (19) in valve body. Install new preformed packing (25) in recess in valve body. Install diaphragm assembly (24) and diaphragm cap (23). Fasten with four screws (20). Insert diaphragm spring (22) in adjusting screw (21) and install parts in diaphragm cap.

CAUTION

Do not attempt to replace the valve core (19) with an automobile tire valve core. Despite their similarity of appearance, a tire valve has not been designed for use with the fuels used in this heater, and will deteriorate rapidly if installed in the fuel control valve instead of valve core furnished for the fuel control valve.

(e) Install three small preformed packings (9) into recesses in valve body. Set restriction orifice plate (8) and 3-hole plate (7) in place and install preformed packing (6). Install insulator plate (5) and outer plate (4) and fasten with three screws (3).

(f) Install washer (30) and coil assembly (31) in restriction solenoid cup and fasten with screw (32). Repeat with the coil assembly (10) in the shut-off solenoid cup. See fig. 3-10.8 for proper orientation of these coils in the valve body.

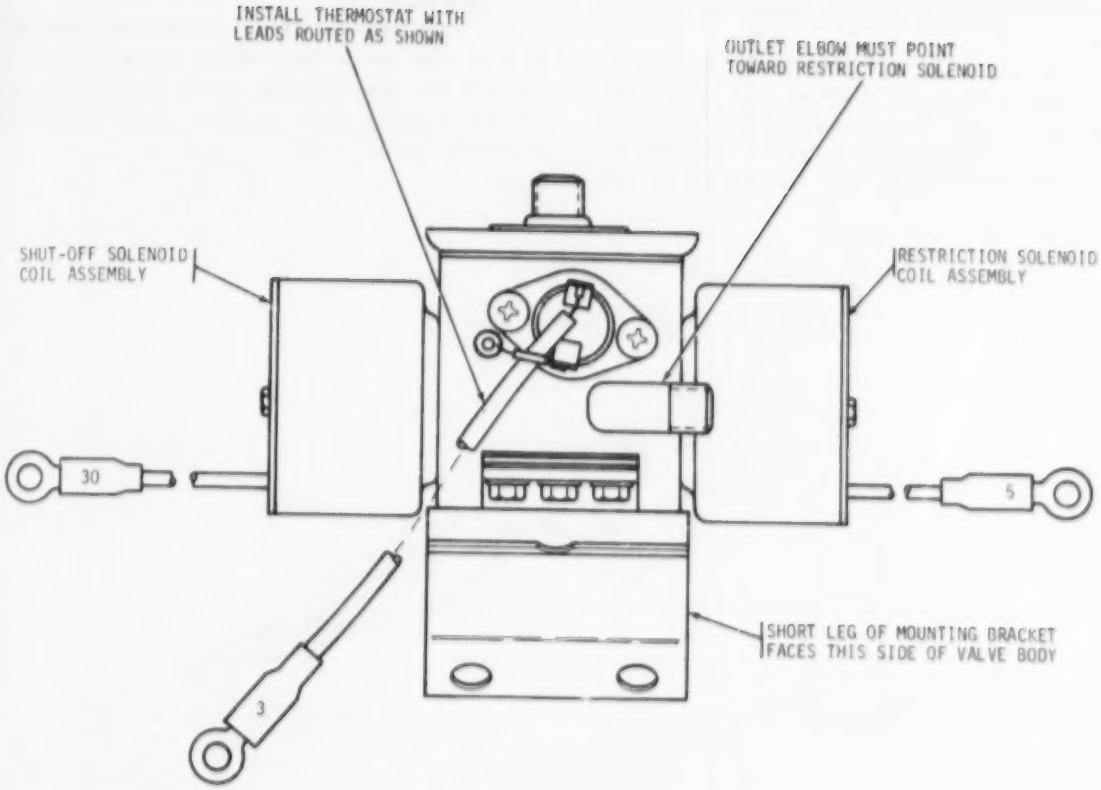

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Figure 3-10.8. Fuel control valve identifying solenoid positions.

CAUTION

Do not overtighten the coil assembly attaching screw. Excessive torque will stretch the sleeve and core assembly and raise the solenoid pull-in voltage.

(g) Press the inlet screen (38, fig. 3-10.4) into the fuel inlet, and screw the valve stem (37) into the valve body. Install the mounting bracket (2) on the valve body as shown in figure 3-10.8, and secure with four screws (1, fig. 3-10.4).

(h) Test the fuel control valve flow rate as follows:

1. Connect the fuel tube (5, fig. 3-10.2) to the fuel control valve outlet elbow, and tighten the compression nut (6). Clamp the assembled valve and fuel tube to a stand or work bench as necessary to simulate the position the fuel control valve will assume when it is installed on the heater, and the heater is installed in a vehicle.

CAUTION

The test must be performed while the valve is in a position as close as possible to its position on the installed heater. Rotating the valve after it has been adjusted will alter the amount of head against which the regulating valve has been set and can significantly alter the flow rate.

2. Connect a supply of fuel under a pressure of 3 to 5 psi to the fuel control valve IN port, and connect the test leads as shown in figure 3-10.9. Place a container under the open end of the fuel tube and apply fuel pressure.

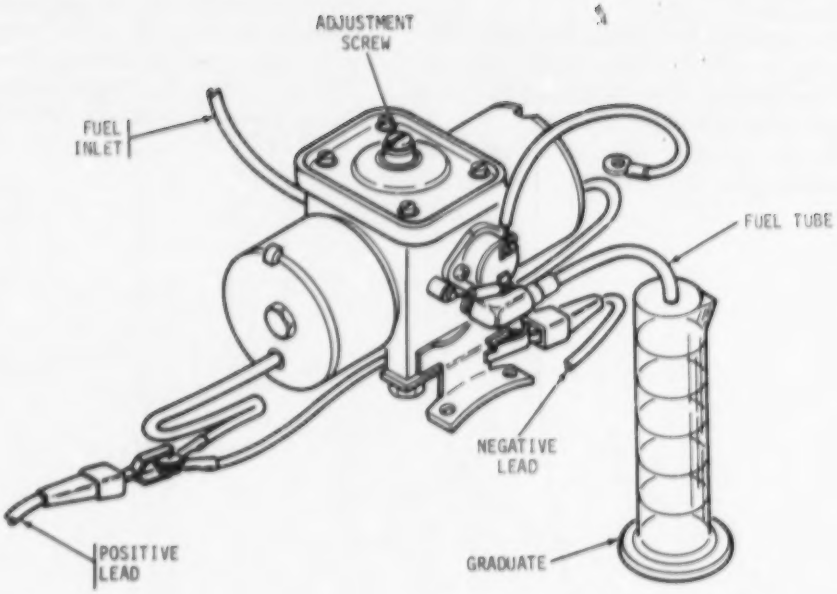

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Figure 3-10.9. Fuel control valve test setup.

3 Energize the solenoids and open the bleed valve (37, fig. 3-10.4). Close the bleed valve when the fuel flowing from it is free of air bubbles. Place a graduate under the end of the fuel tube and start timing the flow. Timing interval must be no less than one minute.

4 At the end of the timing interval, turn off the solenoid switch and place the graduate on an accurate balance to measure the contents. The amount of fuel must be 0.080 ± 0.005 pound per minute for high heat (both solenoids energized). If the flow is not within limits, turn the adjusting screw (21, fig. 3-10.4) clockwise to increase the flow or counterclockwise to decrease the flow, and retest.

5 After the high-heat fuel flow has been adjusted within limits, seal the adjusting screw with G.E. Glyptal varnish No. 1201.

6 Disconnect the test lead to the restriction solenoid lead (No. 5), energize the shut-off solenoid, and measure the low-heat flow. Low-heat flow rate must be 0.044 ± 0.003 pound per minute.

a. If the low-heat flow is above 0.047 pound per minute, the orifice plate is defective. Replace the fuel control valve as an assembly.

b. If the low-heat flow is below 0.041 pound per minute, disassemble the fuel control valve and clean the orifice plate and control valve body as described in paragraph 3-34*f*. Reassemble the valve and retest.

(2) *Burner reassembly* (fig. 3-10.5).

(a) Assemble a notched washer (6), slotted washer (7), and second notched washer (6) over fuel feed bushing on plate and bushing assembly (4). Press retaining washer (8) over bushing assembly to shoulder on bushing, extrusion facing away from the other washers.

(b) A new fuel vaporizer (9) is supplied with the ignition wick (5) already inserted in the hold of a vaporizer with excess length for assembly. Place pre-assembled wick and vaporizer over the fuel feed bushing so the wick will lie in the slot. Use a piece of thin wire to pull the looped end of the wick through the eye of the wick support. Remove the wire and hook the wick into the wick support. See figure 3-10.10.

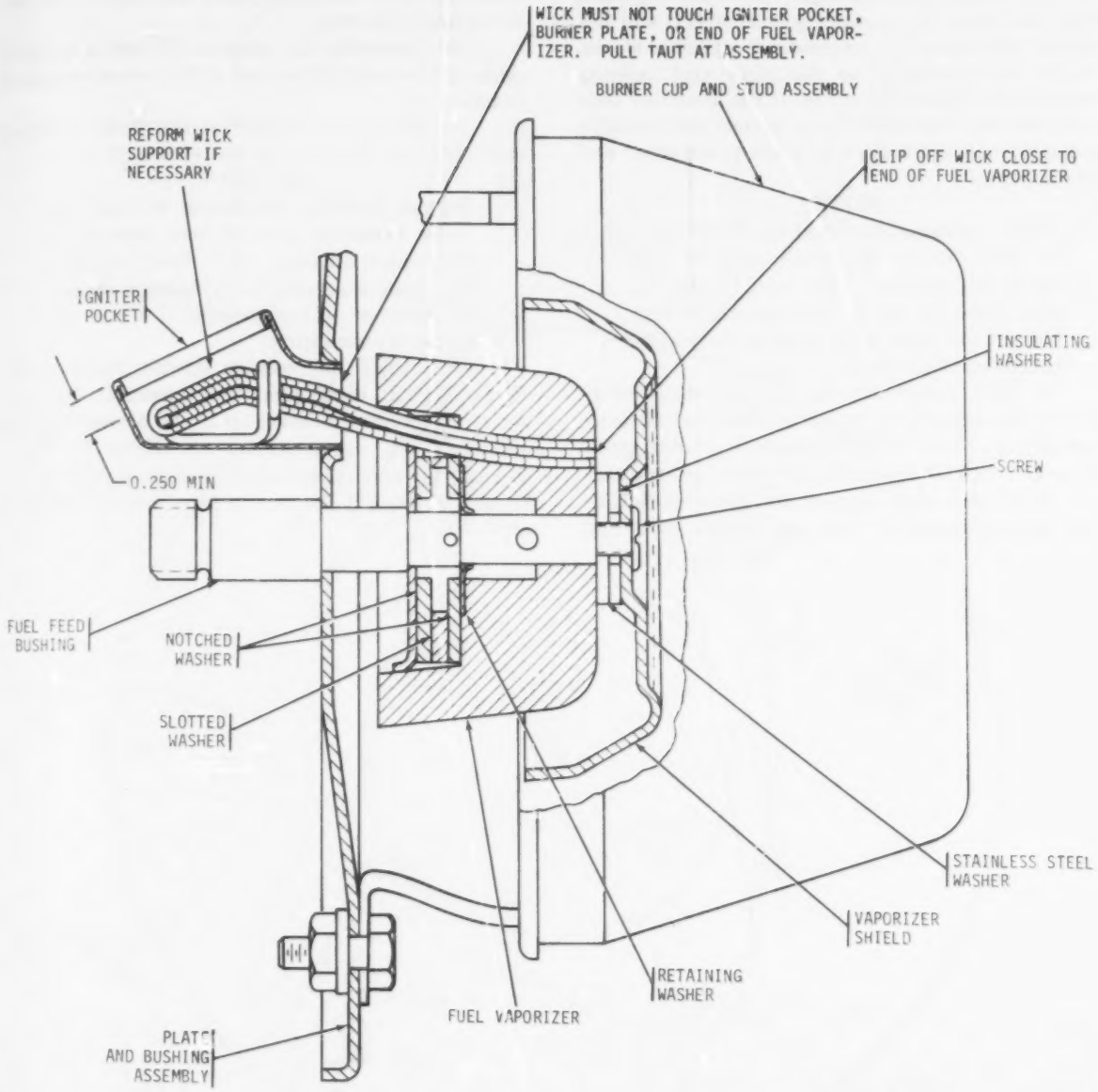

Figure 3-10.10. Cutaway view of burner.

(c) Hold the vaporizer firmly against the retaining washer and pull the wick back through the vaporizer until the wick is taut. Clip off excess wick close to the small end of the vaporizer.

(d) Insert screw through hole in fuel vaporizer shield and slide the insulating washer (11) and flat washer (10) onto screw on inside of vaporizer shield. Attach this assembly to the plate and bushing assembly by tightening screw. If the assembly fails to tighten the vaporizer firmly in position, install a second insulating washer (11) between vaporizer and flat washer (10).

NOTE

When assembled, the fuel vaporizer must be held firmly in place against the retaining washer. The wick must be positioned so that it does not touch any part of the plate and bushing assembly except the wick support.

(e) Slide studs of burner cup and stud assembly (14) through proper holes in plate and bushing assembly (4). Slide three flat washers (3) over studs and secure with three nuts (2) and three lock nuts (1).

(f) Reform wick support in igniter pocket as required to maintain 1/4-inch gap between wick and end of the igniter pocket, as shown in figure 3-10.10.

(3) *Blower reassembly (fig. 3-10.3).*

(a) Install the ventilation blower wheel assembly (6) on the motor shaft and tighten the set-screw until it is snug.

(b) Assemble the resistor (22) and associated parts (19 through 22) on one of the motor mounting brackets (8).

(c) Reconnect the wires to the diode mounting assembly (13), resistor (22), and motor (7).

CAUTION

Do not operate the motor without the diode assembly ground lead secured to the motor housing. This diode protects the diode assembly from damage caused by voltage spikes generated when the motor is deenergized.

(d) Install the voltage limiter assembly (5, figure 3-10.3), diode mounting assembly (13), and resistor mounting bracket (8) in the blower housing assembly (3), using screws (4). Refer to figure 3-10.11 for correct assembly positions. Not all the leads will reach if the components are not installed as shown.

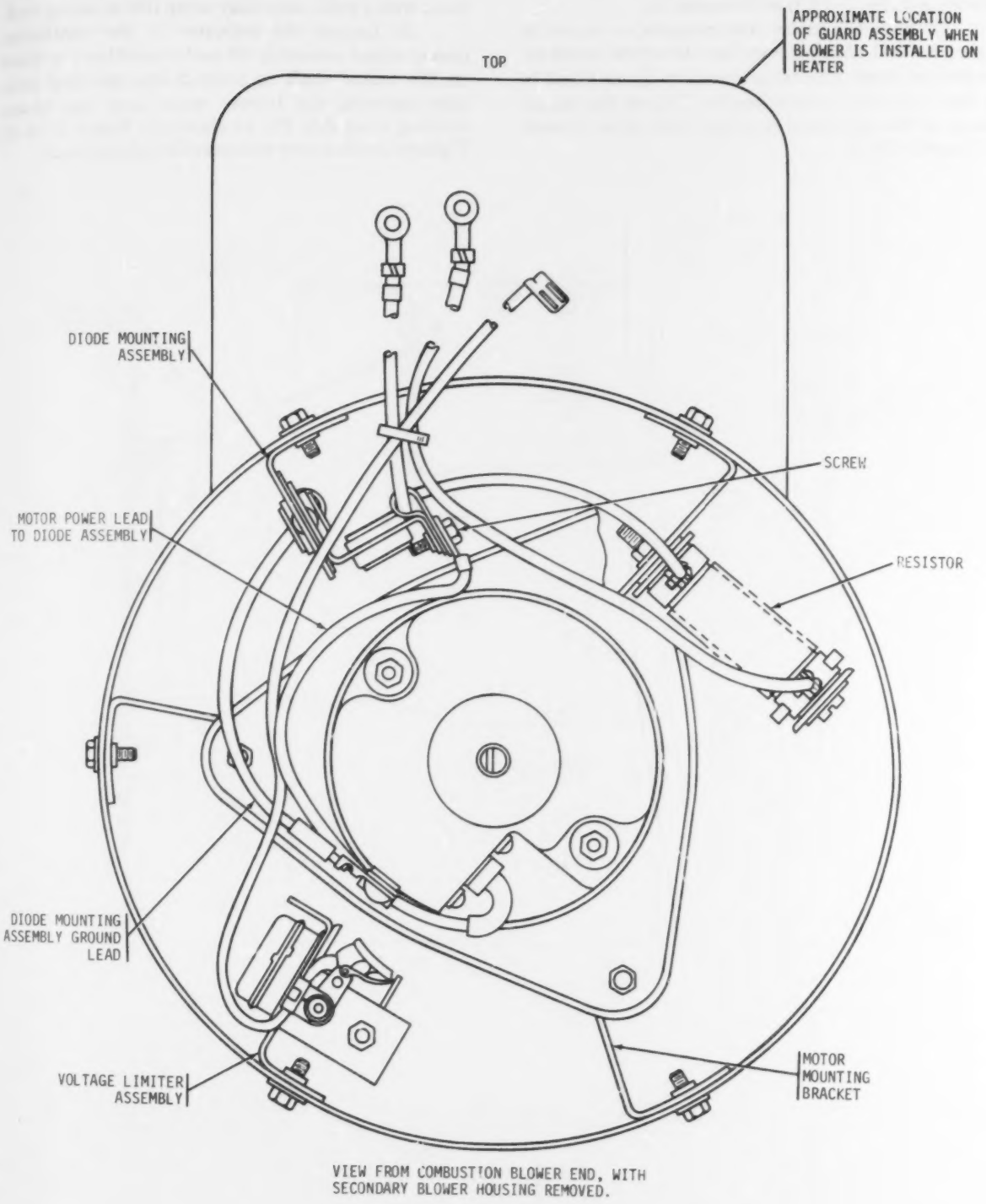
APPROXIMATE LOCATION OF GUARD ASSEMBLY WHEN BLOWER IS INSTALLED ON HEATER
TOP
DIODE MOUNTING ASSEMBLY
SCREW
MOTOR POWER LEAD TO DIODE ASSEMBLY
RESISTOR
DIODE MOUNTING ASSEMBLY GROUND LEAD
VOLTAGE LIMITER ASSEMBLY
MOTOR MOUNTING BRACKET
VIEW FROM COMBUSTION BLOWER END, WITH SECONDARY BLOWER HOUSING REMOVED.
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Figure 3-10.11 Diode assembly, voltage limiter, and resistor installation.

(e) Install the two remaining motor mounting brackets (8, fig. 3-10.3) with screws (4).

(f) Slide the motor into position as shown in figure 3-10.11 making sure that the screw which attaches the diode mounting assembly ground lead is in line with the voltage limiter. Secure the motor flange to the mounting brackets with three screws (9, figure 3-10.3).

(g) Bundle together the three leads and tie them with a cable assembly strap (16) or lacing cord.

(h) Loosen the setscrew in the ventilation blower wheel assembly (6) and reposition the wheel on the motor shaft to achieve the specified clearance between the blower wheel and the blower housing assembly (3), as shown in figure 3-10.12. Tighten the setscrew to secure the adjustment.

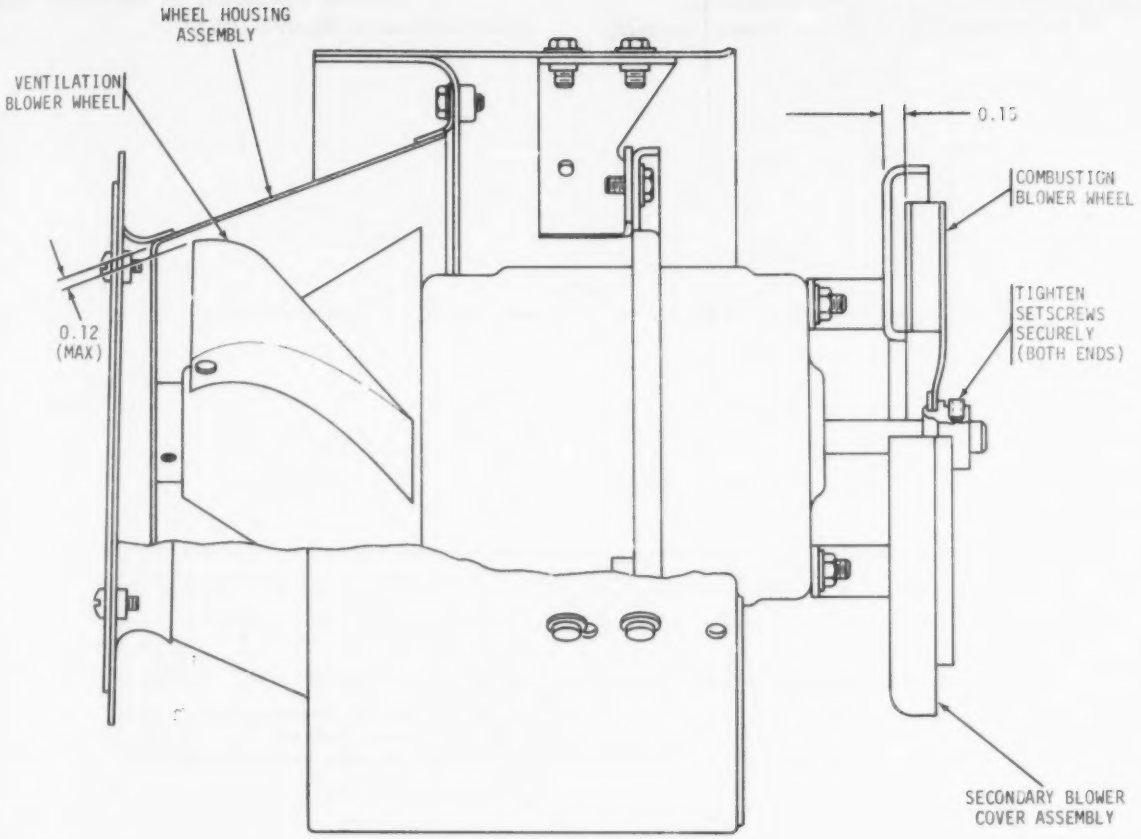


Figure 3-10.12. Blower assembly showing blower wheel clearance.

(i) Position the secondary blower cover assembly (10, fig. 3-10.3) on the motor and secure with nuts (11). Slide the combustion blower wheel (12) onto the motor shaft. Adjust the clearance between the blower wheel and secondary blower cover assembly as shown in figure 3-10.12, and tighten the setscrew securely. A 5/32-inch allen wrench makes a good gage for this clearance.

(j) Install air inlet louver (2, fig. 3-10.3) with four screws (1).

(k) Rotate the blower shaft to make sure that it rotates freely without scraping or binding.

(l) After assembly, test the blower assembly to ensure that it will function properly in the heater assembly. Proceed as follows:

1. The following test equipment is required:

a. DC power supply manually variable from 18 to 28 volts, with a 15 ampere capacity at 24 volts.

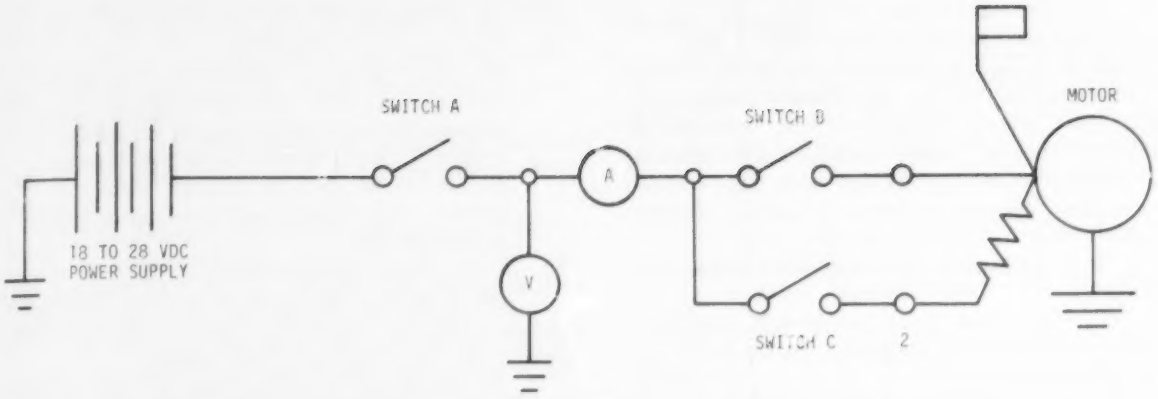
b. Three on-off switches.

c. 0 to 30 volt dc voltmeter.

d. 0 to 15 ampere dc ammeter.

e. Stroboscope type tachometer for determining blower speed.

2. Connect equipment to blower as shown in test schematic, figure 3-10.13.



COMPONENT	SWITCH A	SWITCH B	SWITCH C	VOLTS	CURRENT (AMPERES) MAX	RPM
MODEL 10560B24 HEATER	ON	ON		24	11.5	6000 MIN 6800 MAX
	ON		ON	24	*	*
*Blower must run, but speed and current need not be checked.						

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Figure 3-10.13. Test schematic for blower assembly.

3. Energize power supply and turn on switches A and B. Manually adjust voltage to 20 and then to 28 volts, and allow blower to run 15 to 30 seconds at each voltage. Blower must run freely. Overhaul blower if there is evidence of binding or wear, or if there is any noise which would indicate rough or defective bearings.

4. With switches A and B still closed, adjust power supply to 24 volts. Ammeter should read as indicated in figure 3-10.13. Determine blower speed with tachometer. Speed must be within indicated range.

5. Turn off switch B and turn on switch C. Wait 20 to 30 seconds for blower to slow down. The blower must run smoothly and steadily, but it is not necessary to check motor speed or current draw.

6. Turn off switches A and C, and shut off power. Disconnect blower from test equipment.

(m) If voltage limiter was not tested during blower overhaul, test it now before reassembly. Follow procedure described in paragraph 3-35*b*(1)*(d)*. Voltage limiter may be tested without removing it from blower housing since flag terminal is accessible. Voltage limiter is grounded through blower housing.

(4) Heat exchanger assembly installation (fig. 3-10.2).

(a) Connect one end of the ground lead assembly (12) to the heater housing (28), and secure with a nut (14) and lockwasher (13).

(b) Spread the heater housing assembly and insert the heat exchanger assembly (15) in the housing. Install the four screws (34) that secure the housing seam.

(c) Connect the other end of ground lead assembly (12) to the heat exchanger and secure with screw (11).

(5) *Flame detector switch installation (fig. 3-10.7).*

(a) Insert the ceramic rod (fig. 3-10.7) into the tube. Flip the microswitch back into position and install the adjusting screw.

(b) Slowly turn in the adjusting screw (fig. 3-10.7) until the switch just clicks, then exactly ½ turn more. Secure the adjustment by sealing the adjusting screw with G.E. Glyptal varnish, No. 1201.

(c) Install the flame detector switch (21, fig. 3-10.2) in the heater and tighten the compression nut (22) on the underside of the switch, making sure that the switch assembly is positioned crosswise to the axis of the heater so that the guard can be installed.

(d) Connect the wires to the NC and NO contacts on the switch and secure with the screws (20).

(6) *Igniter installation (fig. 3-10.2).*

(a) Be sure the seal (35) is seated in the top of the heater housing (28).

(b) If a new igniter is being installed, connect the shorter lead to the ground terminal (31) on the top of the heater. Connect the longer lead to the ignition control (25).

(c) Install the igniter (9) in the igniter tube (8). Use a screwdriver with a long, thin blade to press the element end of the igniter firmly into the igniter tube to ensure that the igniter is firmly seated.

(d) Press the igniter down and turn it clockwise to engage the pin on the top of the igniter with the slots in the igniter tube. Reinstall the electrical inlet assembly (36) and secure with the Dzus fasteners.

(e) Reconnect electrical cable to the heater.

NOTE

If the igniter requires frequent replacement, test the operation of the voltage limiter as described in paragraph 3-35*b*(1)*d*. An inoperative voltage limiter allows surges of high voltage from the ignition control to damage the igniter and shorten its life.

(7) *Ignition control installation (fig. 3-10.2).*

(a) Slide the new ignition control (25) under the two loosened screws (17), install the remaining two screws, and tighten all four screws.

(b) Route the ignition control lead through the bundle of wires and connect it to the flame detector switch (21). If the fuel control valve (26) was removed, reinstall it, as below, and bundle the wires with two cable assembly straps (37) or lacing cord, one on each side of the fuel control valve mounting bracket.

(c) Connect the igniter lead and voltage limiter lead to the spade terminals on the ignition control.

(8) *Fuel control valve installation (fig. 3-10.2).*

(a) Slide the fuel control valve mounting bracket under one screw (27) and engage the fuel tube (5) in the outlet elbow on the control valve. Start the compression nut (6) on the elbow, then install and tighten the remaining two screws (27). Tighten the compression nut. Check that all the loose wires are retained between the fuel control valve mounting bracket and the heater housing.

(b) Connect leads 3, 5, and 30.

(c) Bundle the wires and secure them with two cable assembly straps (37) or lacing cord, with one strap on each side of the control valve mounting bracket.

(d) Connect the fuel supply line to the IN port

on the control valve body, and bleed the fuel line and valve body as described in paragraph 3-33*c*(6).

(9) *Overheat switch (fig. 3-10.2).*

(a) Install the overheat switch (24) on the heater and secure with the two screws (18).

(b) Connect the wires to the terminals on the top of the switch and secure with the two screws (19).

(10) *Electrical inlet assembly installation (fig. 3-10.2).*

(a) Connect the lead from connector D on the receptacle to the terminal on the flame detector switch (21) by installing a screw (20).

(b) If the igniter has been removed, install it as described in *b*(6) above.

(c) Install terminal (31) and washers (30 and 32) on the grounding stud on the heater housing. Connect the electrical inlet assembly ground lead from connector terminal A to the grounding stud and secure with nut (29). Install the igniter ground on terminal (31).

(d) Install the electrical inlet assembly on the heater housing and secure by tightening the two fasteners.

(11) *Burner assembly installation (fig. 3-10.2).*

(a) Position burner assembly (10) so that the burner assembly flange engages the flange in the heat exchanger (15); secure with six screws (39).

(b) Position the secondary blower housing (3) on the heat exchanger assembly (15) so that it fits snugly against the burner assembly. The neck on the housing must aline with the hole in the heater housing.

(c) Connect the fuel tube (5) to the fuel bushing on the burner assembly (10), and to the fuel control valve outlet elbow.

(d) Install the igniter tube and bracket (8) in the heater, and check that it seats properly in the igniter pocket on the burner assembly (10). Secure the tube to the secondary blower housing (3) with the screw (4).

(e) Install the igniter (*b*(6) above.

(12) *Blower assembly installation (fig. 3-10.2).*

(a) Feed the three leads from the blower assembly (1) through the hole in the heater housing (28). Slide the grommet (33) onto the leads and work the grommet into the hold in the heater housing.

(b) Position the blower assembly on the heater housing so that the leads are toward the top of the housing, as shown in figure 3-10.11. Aline the slotted mounting holes with the tapped holes in the heater housing and secure the blower assembly by installing and tightening the four screws (2, fig. 3-10.2).

(c) Make all necessary electrical connections.

(d) Install the guard assembly (16, fig. 3-10.2) and secure by tightening the two fasteners.

c. Deflector Installation. Install the deflector on the personnel heater as shown in figure 3-9.

d. Air Control Assembly Installation. Install the air control assembly on the personnel heater as shown in figure 3-9.

e. Personnel Heater Assembly Installation. Refer to TM 9-2350-256-20 for instructions on installation of the personnel heater assembly in the vehicle.

3-36.1. Testing

a. Subassembly Tests. Before conducting tests of the assembled heaters, the following tests and calibrations should have been performed during disassembly for repairs. If they were not performed at that time, do them before the heater assembly is tested.

(1) Flame detector switch calibration. See paragraph 3-36*b*(5).

(2) Blower speed test. See paragraph 3-36*b*(3)(1).

(3) Voltage limiter test. See paragraph 3-35*b*(1)(*d*).

(4) Fuel control valve flow test and calibration. See paragraph 3-36*b*(1)(*h*).

b. Test Equipment.

(1) DC power supply manually adjustable from 18 to 30 volts, with a continuous 15-amp capacity.

(2) Two on-off switches.

(3) A normally open (NO) 24-volt relay, 20-amp capacity.

(4) 0 to 20 amp dc ammeter.

(5) 0 to 30 volt dc voltmeter (V1).

(6) 0 to 20 volt dc voltmeter (V2).

(7) 24-volt pilot lamp.

(8) Connector to mate with receptacle on heater.

(9) Filtered supply of No. 2 diesel fuel (Federal Spec. VV-F-800 Grade II), supplied at 5 ± 1/2 psig.

(10) A pyrometer duct constructed to the dimensions shown in figure 3-10.14 and fitted with a thermometer or pyrometer which reads up to 600°F.

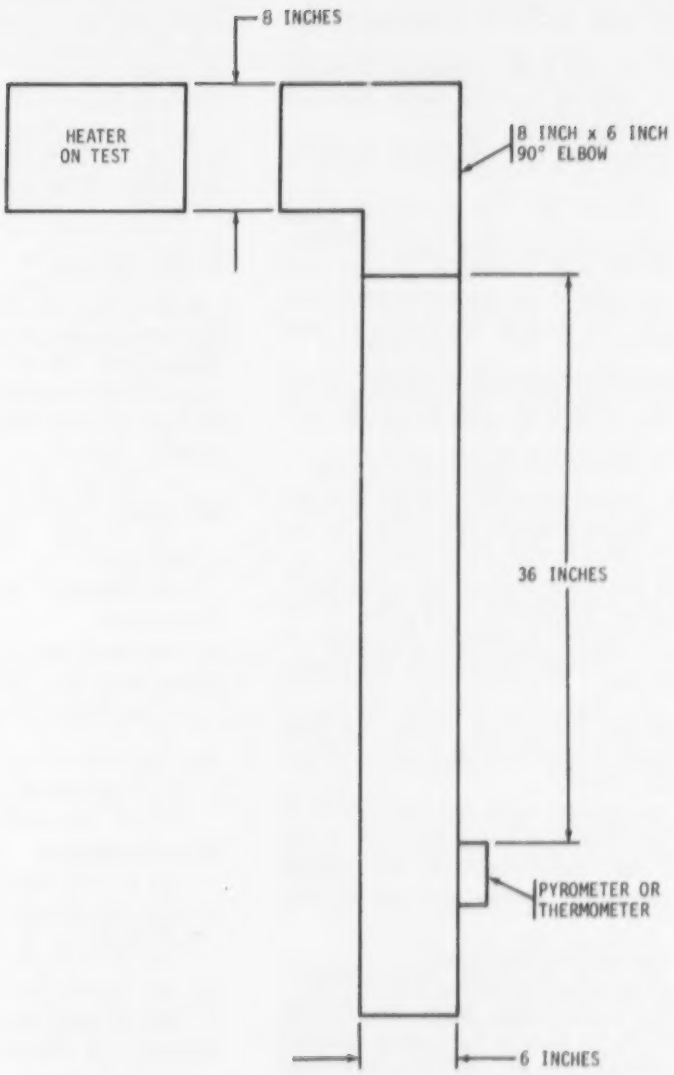

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Figure 3-10.14. Pyrometer duct dimensions.

on the control valve body, and bleed the fuel line and valve body as described in paragraph 3-33*c*(6).

(9) *Overheat switch (fig. 3-10.2).*

(a) Install the overheat switch (24) on the heater and secure with the two screws (18).

(b) Connect the wires to the terminals on the top of the switch and secure with the two screws (19).

(10) *Electrical inlet assembly installation (fig. 3-10.2).*

(a) Connect the lead from connector D on the receptacle to the terminal on the flame detector switch (21) by installing a screw (20).

(b) If the igniter has been removed, install it as described in *b*(6) above.

(c) Install terminal (31) and washers (30 and 32) on the grounding stud on the heater housing. Connect the electrical inlet assembly ground lead from connector terminal A to the grounding stud and secure with nut (29). Install the igniter ground on terminal (31).

(d) Install the electrical inlet assembly on the heater housing and secure by tightening the two fasteners.

(11) *Burner assembly installation (fig. 3-10.2).*

(a) Position burner assembly (10) so that the burner assembly flange engages the flange in the heat exchanger (15); secure with six screws (39).

(b) Position the secondary blower housing (3) on the heat exchanger assembly (15) so that it fits snugly against the burner assembly. The neck on the housing must aline with the hole in the heater housing.

(c) Connect the fuel tube (5) to the fuel bushing on the burner assembly (10), and to the fuel control valve outlet elbow.

(d) Install the igniter tube and bracket (8) in the heater, and check that it seats properly in the igniter pocket on the burner assembly (10). Secure the tube to the secondary blower housing (3) with the screw (4).

(e) Install the igniter (*b*(6) above.

(12) *Blower assembly installation (fig. 3-10.2).*

(a) Feed the three leads from the blower assembly (1) through the hole in the heater housing (28). Slide the grommet (33) onto the leads and work the grommet into the hold in the heater housing.

(b) Position the blower assembly on the heater housing so that the leads are toward the top of the housing, as shown in figure 3-10.11. Aline the slotted mounting holes with the tapped holes in the heater housing and secure the blower assembly by installing and tightening the four screws (2, fig. 3-10.2).

(c) Make all necessary electrical connections.

(d) Install the guard assembly (16, fig. 3-10.2) and secure by tightening the two fasteners.

c. Deflector Installation. Install the deflector on the personnel heater as shown in figure 3-9.

d. Air Control Assembly Installation. Install the air control assembly on the personnel heater as shown in figure 3-9.

e. Personnel Heater Assembly Installation. Refer to TM 9-2350-256-20 for instructions on installation of the personnel heater assembly in the vehicle.

3-36.1. Testing

a. Subassembly Tests. Before conducting tests of the assembled heaters, the following tests and calibrations should have been performed during disassembly for repairs. If they were not performed at that time, do them before the heater assembly is tested.

(1) Flame detector switch calibration. See paragraph 3-36*b*(5).

(2) Blower speed test. See paragraph 3-36*b*(3)(1).

(3) Voltage limiter test. See paragraph 3-35*b*(1)(*d*).

(4) Fuel control valve flow test and calibration. See paragraph 3-36*b*(1)(*h*).

b. Test Equipment.

(1) DC power supply manually adjustable from 18 to 30 volts, with a continuous 15-amp capacity.

(2) Two on-off switches.

(3) A normally open (NO) 24-volt relay, 20-amp capacity.

(4) 0 to 20 amp dc ammeter.

(5) 0 to 30 volt dc voltmeter (V1).

(6) 0 to 20 volt dc voltmeter (V2).

(7) 24-volt pilot lamp.

(8) Connector to mate with receptacle on heater.

(9) Filtered supply of No. 2 diesel fuel (Federal Spec. VV-F-800 Grade II), supplied at 5 ± 1/2 psig.

(10) A pyrometer duct constructed to the dimensions shown in figure 3-10.14 and fitted with a thermometer or pyrometer which reads up to 600°F.

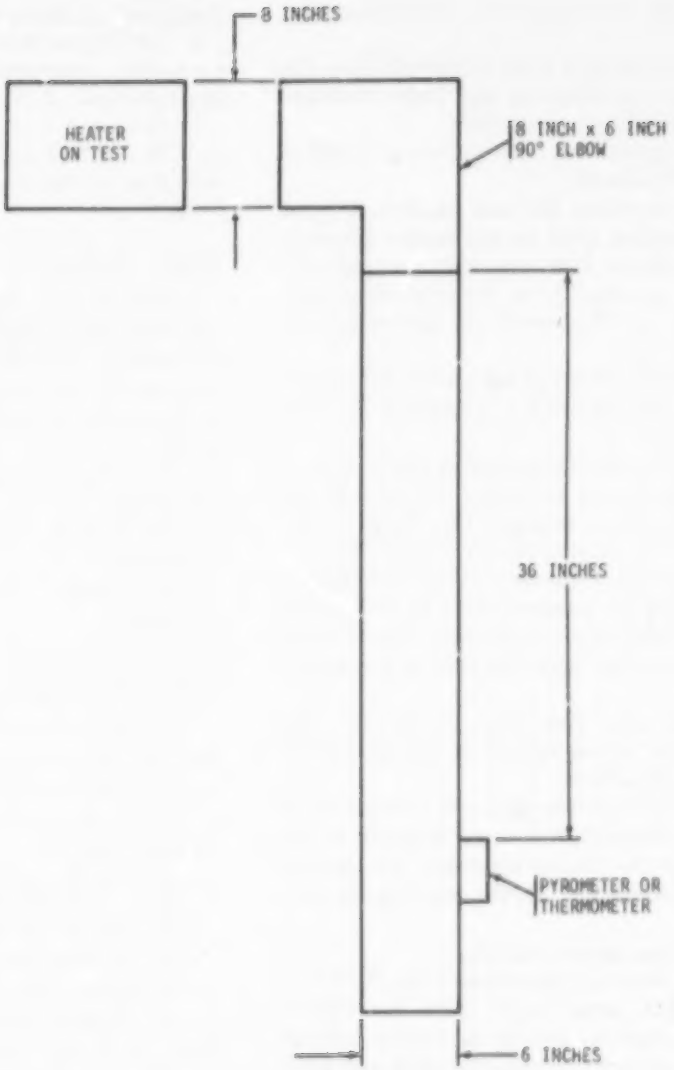

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Figure 3-10.14. Pyrometer duct dimensions.

c. Test Setup.

(1) Mount the heater on the test stand in the same position it will be in when installed for use.

(2) Turn off all electrical switches.

(3) Connect fuel supply to the fuel control valve of heater.

(4) Fasten the pyrometer duct to the outlet end of the heater.

(5) Connect meter V2 to igniter lead on ignition control (terminal with two wires).

(6) Connect remaining electrical equipment as shown in test schematic, figure 3-10.15.

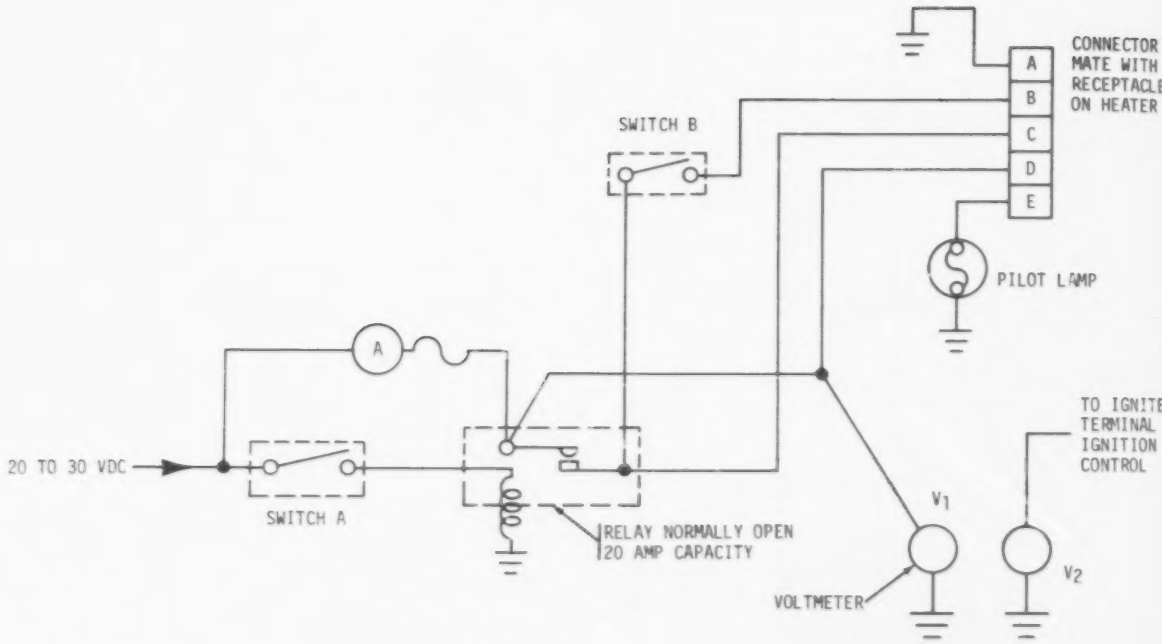

Figure 3-10.15. Test schematic for complete heater assembly.

d. Test Procedure.

(1) Energize power supply and adjust to read 20 volts on V1. Open valve to the fuel supply.

(2) Leave switch B in the off position (LO), and turn switch A. Make the following observations during starting cycle:

(*a*) Ignition time. Ignition of this heater may be inaudible when burning diesel fuel. Ignition must occur within 75 seconds maximum. If exact ignition time cannot be determined, flame detector switch crossover (indicated by pilot lamp lighting up) must be the determining factor. Flame detector switch must light pilot lamp within 105 seconds.

(*b*) Electric current as measured by ammeter must be 12.5 amperes or less.

NOTE

The fuel control valve contains a fuel heater which may be energized in ambients below 70° F, drawing an extra 3.5 to 4.7 amperes. If this occurs, disconnect the thermostat lead (No. 3 from the fuel control valve) from the terminal strip on the heater and retest.

(3) Immediately after flame detector switch trips, turn on switch B (heater on HI). Adjust power supply to read 24 volts on voltmeter V_1, and observe the ammeter during running cycle. Electric current must be 10.5 amperes maximum.

(4) Let heater run for two minutes, and inspect exhaust. No smoke should be visible.

NOTE

Visible smoke after two minutes of operation is not acceptable. Check for low voltage, a slow-running motor, or improperly calibrated fuel control valve. Some visible white smoke is normal until the flame detector switch trips.

(5) Restrict air flow into the ventilating air blower until the overheat switch opens. Read the temperature of the switch on the thermometer. Overheat cutout temperature must be 350° to 500° F.

(6) Remove ventilating air restriction. Heater should resume burning without requiring a return to the start cycle.

(7) Adjust power supply to read 30 volts on voltmeter V_1 and turn off switch B. Allow heater to run for at least one minute. It must continue to burn smoothly.

(8) Adjust power supply to read 24 volts on voltmeter V_1 and turn off switch A to shut off heater. Observe the time required for blower to shut off. Purge time must be between 80 and 150 seconds.

(9) If heater does not meet specifications, repair and retest.

(10) Shut off power supply and fuel. Allow heater to cool to a temperature at which it is easy to handle. Disconnect the fuel and electrical connections and remove the pyrometer duct. Remove heater from test stand.

Section VII.

Deleted

Paragraphs 3–37 through 3–41.

Deleted

Section VIII. REPAIR OF ELECTRICAL COMPONENTS

3-42. General

The following paragraphs in this section cover the repair of miscellaneous items of electrical equipment. Organizational maintenance has the responsibility for repair and replacement of all electrical components except wiring harnesses and leads, master and armature relay and housing assemblies, auxiliary power unit control box, generator switching relay box, high voltage powerpack and bilge pump electrical system components. Repair and replacement of these items is the responsibility of direct and general support maintenance personnel.

3-43. Description

For a description of the electrical components discussed in this section, refer to paragraph 1-3*g*.

3-44. Storage Batteries

WARNING

Handle batteries with care. Battery acid is extremely hazardous.

Refer to TM 9-2350-256-20 for removal, installation and service. Refer to TM 9-6140-200-12 for repair instructions.

3-45. Auxiliary Power Unit Control Box

a. Removal. Refer to TM 9-2350-256-20 for removal procedures.

b. Disassembly. Instructions for disassembling the APU control box are found in figure 3-11.

Section VIII. REPAIR OF ELECTRICAL COMPONENTS

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3-43. Description

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3-44. Storage Batteries

WARNING

Handle batteries with care. Battery acid is extremely hazardous.

Refer to TM 9-2350-256-20 for removal, installation and service. Refer to TM 9-6140-200-12 for repair instructions.

3-45. Auxiliary Power Unit Control Box

Deleted.

Figure 3-11. Deleted.

able 3-1. Deleted.

.46. Master Relay and Housing Assembly

a. Removal. Refer to TM 9-2350-256-20 for removal nd installation instructions.

b. Disassembly.

(1) General. Figure 3-12 with its accompanying egend identifies the parts of the master relay and ousing assembly. This legend also provides an in- dex to the step-by-step removal (figure 3-13) of each part during disassembly.

Legend for figure 3-12:
1 Shell (D)
2 Gasket (D)
3 Insert (D)
4 Housing (E)
5 Lockwasher (D)
6 Screw (D)
7 Washer (A)
8 Lock washer (A)
9 Screw (A)
10 Cover (A)
11 Gasket (A)
12 Screw (D)
13 Lockwasher (D)
14 Washer (D)
15 Bus bar (D)
16 Nut* (E)
17 Lockwasher* (E)
18 Washer* (E)
19 Stud* (E)
20 Screw (E)
21 Lockwasher (E)
22 Washer (E)
23 Relay assembly (E, F)
24 Insulator (F)
25 Receptacle assembly (B, C)
26 Receptacle gasket (B)
27 Lockwasher (B)
28 Screw (B)
*Master relay only

Note: The letters in parentheses refer to figure 3-13 view

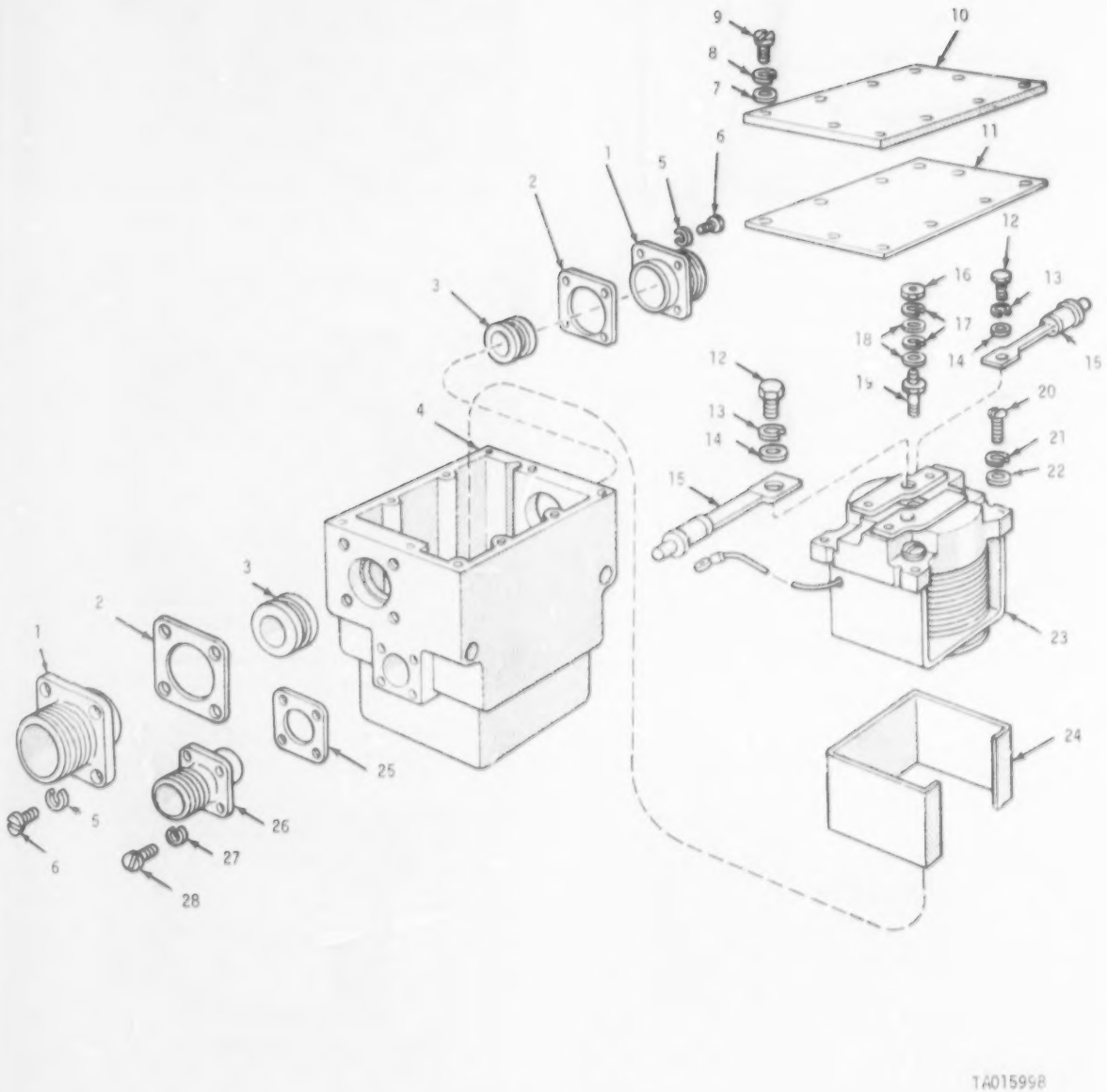
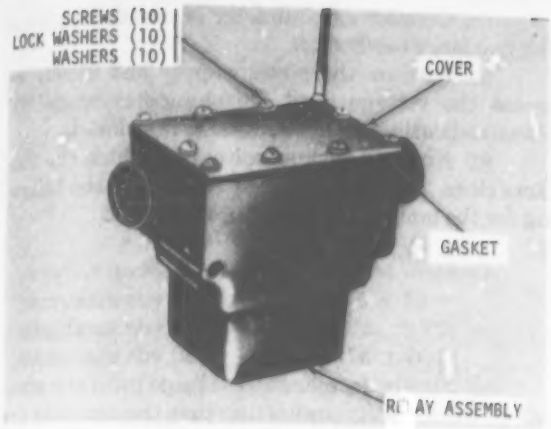
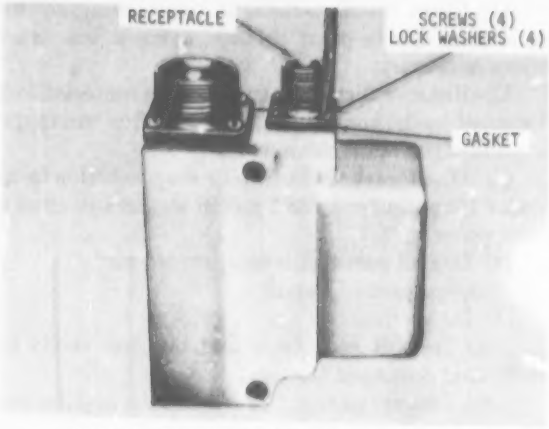


Figure 3-12. Relay and housing assembly – exploded view.

(2) *Master Relay and Housing Assembly.* Disassemble the master relay and housing assembly as shown in figure 3-13.



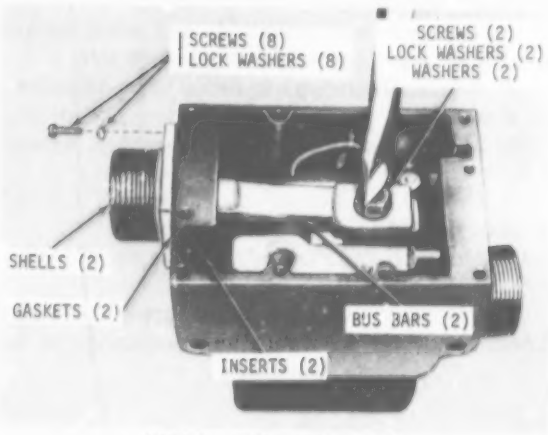
VIEW A. COVER AND GASKET.



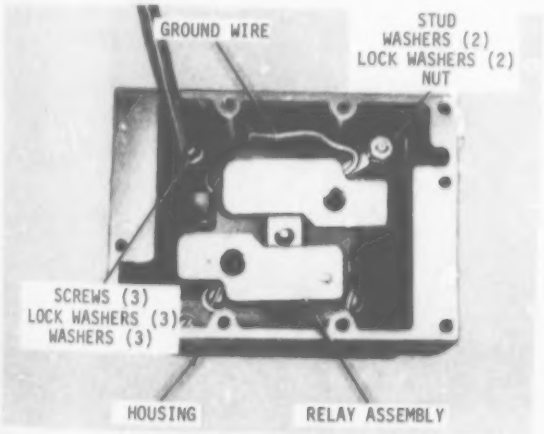
VIEW B. RECEPTACLE ASSEMBLY AND GASKET.

INSTALLATION: REFER TO TB SIG 222 FOR SOLDERING METHODS AND TYPES OF SOLDER TO BE USED.
LEAD WIRE
SOLDER GUN
RECEPTACLE
NOTE: DISCONNECT LEAD WIRE AND REMOVE RECEPTACLE.

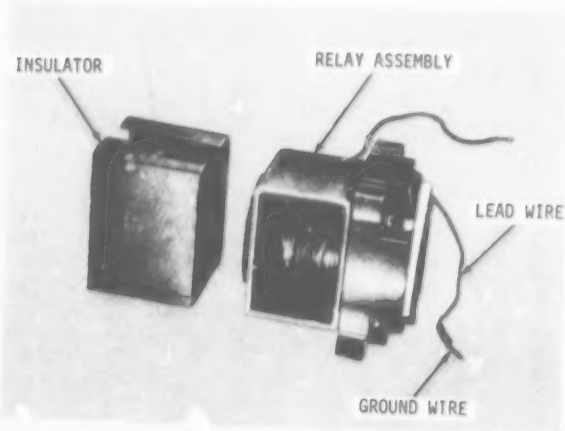
VIEW C. DISCONNECT LEAD WIRE.



VIEW D. SHELL AND BUS BAR.



VIEW E. GROUND TERMINAL AND RELAY.



VIEW F. RELAY AND INSULATOR.

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Figure 3-13. Relay and housing assembly--disassembly and assembly

(3) Deleted

c. Cleaning.

(1) Clean metal parts with drycleaning solvent or mineral spirits paint thinner, using a wire brush where necessary.

(2) Remove dirt and other foreign material from electrical leads, connectors, etc. with fine sandpaper or a wire brush and clean water.

(3) Wash gaskets in a mild soap solution (a ration of 1/2 pound soap to 1 gallon water) and rinse in clean water.

(4) Dry all parts with compressed air.

d. Inspection and Repair.

(1) *Inspection.*

(a) Inspect receptacle and bus bar shells for cracks and damaged threads.

(b) Inspect gaskets for tears, cuts, and hardening.

(c) Inspect lead and ground wires for breaks and faulty insulation.

(d) Inspect relay assembly and other components for damage that would impair their use.

(2) *Repair.* Replace parts found to be defective.

e. Assembly.

(1) Master relay and housing assembly. Assemble in reverse order of disassembly.

(2) *Deleted.*

f. Test.

(1) *Master Relay Pickup, Dropout, and Continuity Test.*

(a) Connect a variable power supply (0–24 vdc) between the center pin of the small receptacle and the case of the relay (negative lead of power supply to relay case).

(b) Connect an ohmmeter between the pins of the two large receptacles.

(c) Turn on the power supply and slowly increase the voltage until the ohmmeter reads "0" ohms, indicating that the contacts are closed.

(d) Note the pickup voltage at which the contacts close. This voltage must not exceed the following for the ambient temperature indicated.

Ambient temperature	*Pickup voltage*
−65 ± 5°F	12 vdc maximum
77 ± 15°F	16 vdc maximum
160 ± 5°F	20 vdc maximum

(e) Slowly decrease the voltage until the ohmmeter reads infinity, indicating that the contacts are open.

(f) Note the dropout voltage at which the contacts open. This voltage must read between 0.7 vdc minimum and 5 vdc maximum at any test temperature.

(2) Deleted.

3-47. Switching Relay Box Assembly (deleted)

Figure 3-14 (deleted)
Legend for figure 3-14: (deleted)
Figure 3-15 (deleted)
Figure 3-16 (Sheet 1 of 2) (deleted)
Figure 3-16 (Sheet 2 of 2) (deleted)
Table 3-2. Deleted

(Next printed page is 3-33)

Figure 3-17. (Sheet 1 of 2). Deleted.

Figure 3-17. (Sheet 2 of 2). Deleted.

(*b*) Deleted.
Caution. Deleted.
(*c*) Deleted.

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Figure 3-18. Deleted.

(*d*) Through (*o*). Deleted.

Figure 3-19. Deleted.

(*p*). Deleted.
(*q*). Deleted.

3-48. Wiring Harness

a. Removal. Refer to TM 9-2350-256-20 for removal and installation instructions.

b. Disassembly.

(1) Unwrap or cut tape which binds the wires or cables to the old harness.

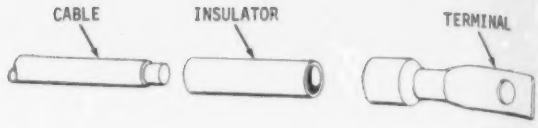
(2) Lay out the old harness with all splices exposed, so that it can be used as a model for building the new harness.

(3) Tag or otherwise identify all wires or cables.

(4) Remove all cable connectors.

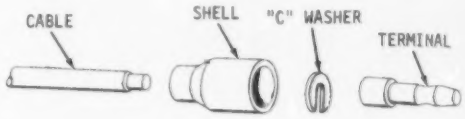
c. Inspection.

(1) *She'l and Terminal Assemblies.* Refer to A, B and C, figure 3-20.



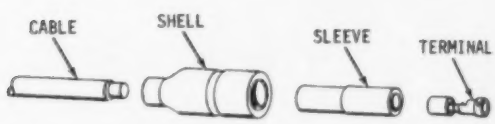
1. STRIP CABLE INSULATION EQUAL TO DEPTH OF TERMINAL WELL.
2. SLIDE INSULATOR OVER CABLE
3. INSERT CABLE INTO TERMINAL WELL, AND CRIMP.
4. SLIDE INSULATOR OVER CRIMPED END OF TERMINAL.

A - TERMINAL-TYPE CABLE CONNECTOR



1. STRIP CABLE INSULATION EQUAL TO DEPTH OF TERMINAL WELL.
2. SLIDE SHELL OVER CABLE.
3. INSERT CABLE INTO TERMINAL WELL, AND CRIMP.
4. PLACE "C" WASHER OVER CABLE AT CRIMPED JUNCTION AND SLIDE SHELL OVER "C" WASHER AND TERMINAL.

B - MALE CABLE CONNECTOR



1. STRIP CABLE INSULATION EQUAL TO DEPTH OF TERMINAL WELL.
2. SLIDE SHELL AND SLEEVE OVER CABLE.
3. INSERT CABLE INTO TERMINAL WELL, AND CRIMP.
4. SLIDE SHELL AND SLEEVE OVER TERMINAL.

C - FEMALE CABLE CONNECTOR (WITH SLEEVE)

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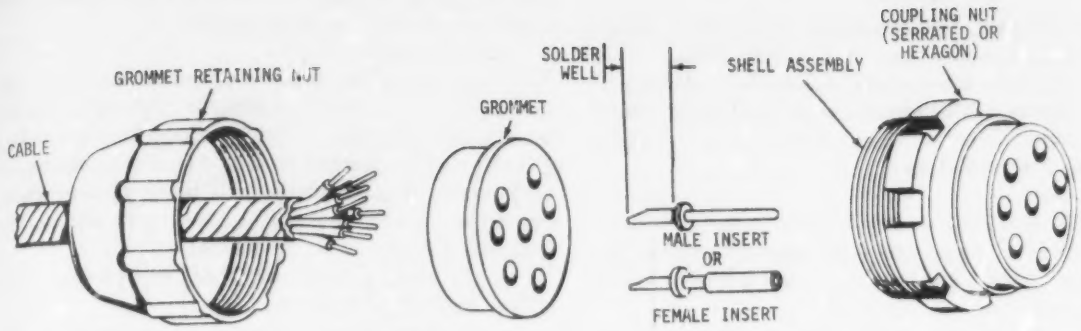
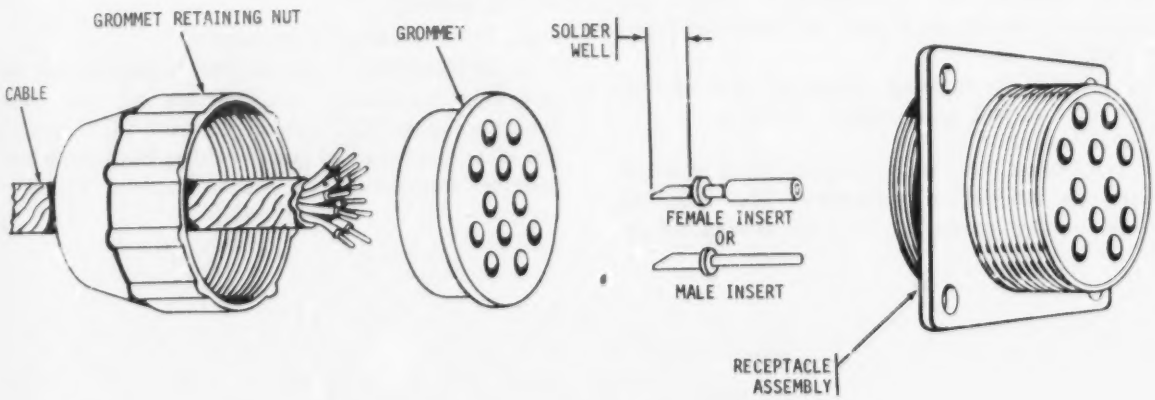
Figure 3-20. Wiring harness cable connectors—repair (Sheet 1 of 2)



1. STRIP CABLE INSULATION EQUAL TO DEPTH OF SOLDER WELLS OF INSERTS.
2. PASS CABLE ENDS THROUGH GROMMET RETAINING NUT, GROMMET AND COUPLING NUT, INSERT INTO SOLDER WELLS OF INSERTS AND SOLDER. (TB SIG 222)
3. SLIDE GROMMET OVER INSERTS AND PRESS INTO SHELL ASSEMBLY UNTIL SEATED.
4. THREAD GROMMET RETAINING NUT TO SHELL ASSEMBLY UNTIL SEATED.

D. Plug assemblies



1. STRIP CABLE INSULATION EQUAL TO DEPTH OF SOLDER WELLS OF INSERTS.
2. PASS CABLE ENDS THROUGH GROMMET RETAINING NUT AND GROMMET, INSERT INTO SOLDER WELLS OF INSERTS AND SOLDER. (TB SIG 222)
3. SLIDE GROMMET OVER INSERTS AND PRESS INTO RECEPTACLE ASSEMBLY UNTIL SEATED.
4. THREAD GROMMET RETAINING NUT INTO RECEPTACLE UNTIL SEATED.

E. Receptacle assemblies

NOTE 1. DO NOT DISTORT SKIRTS OF TERMINAL WHEN CRIMPING TO CABLE. TA016004

NOTE 2. IN PLUG AND RECEPTACLE ASSEMBLIES, PLUG ALL SPARE GROMMET HOLES WITH ROD (NSN 9390-00-180-7289).

Figure 3-20. Wiring harness cable connectors—repair (Sheet 2 of 2).

(*a*) Inspect for cracks, tears, cuts, chips and gouges.

(*b*) Inspect for condition of material and discard parts showing any sign of hardening.

(2) *Plug and Receptacle Assemblies.* Refer to D and E, figure 3-20. Inspect for cracks, dents, bent inserts, cross threading and damage that would impair their serviceability.

d. Repair.

(1) *General.* Before repairing a harness, clean thoroughly of dirt and other accumulations with a brush and clean water. Dry and perform the following inspection prodcdures.

(*a*) Inspect harness for frayed areas.

(*b*) Inspect individual leads for cuts and other evidence of excessive wear and for missing, damaged and illegible circuit number and part number markers.

(*c*) Inspect all cable connectors as described in paragraphs *c*(1) and *c*(2) above.

(2) *Procedure.*

(*a*) Tape frayed areas.

(*b*) Remove defective leads and replace, reusing cable connectors (fig. 3-20) where possible. Use spare harness leads, if present, as replacement or cut a new length of cable of proper gage and assemble into the harness (refer to para. *e* (2) below).

(*c*) Remove the disassemble damaged and defective connectors and install new connector parts (fig. 3-20).

(*d*) Replace missing, damaged and illegible circuit number and part number markers.

e. Assembly.

(1) *General.* Continuity checks are performed during the fabrication procedure. The following sections of this paragraph provide procedural instructions for step-by-step assembly and for splicing and wrapping. Figure 3-20 provides instructions for assembly of connectors to cables.

(2) *Procedure.*

(*a*) Using the pattern of the old harness, cut new cable to the required lengths and complete all splices. Spliced cables must be adequately insulated and the insulation must be sealed to the insulation of each cable. Wrap with ¾-inch black plastic sheet tape-type insulation or use heat-shrinkable promolded covers when available.

(*b*) Make a continuity check of each cable and splice, using an ohmmeter.

(*c*) Assemble connectors to cables as identified in disassembly (see fig. 3-20).

(*d*) Make another continuity check between opposite ends of cables through appropriate connector pins.

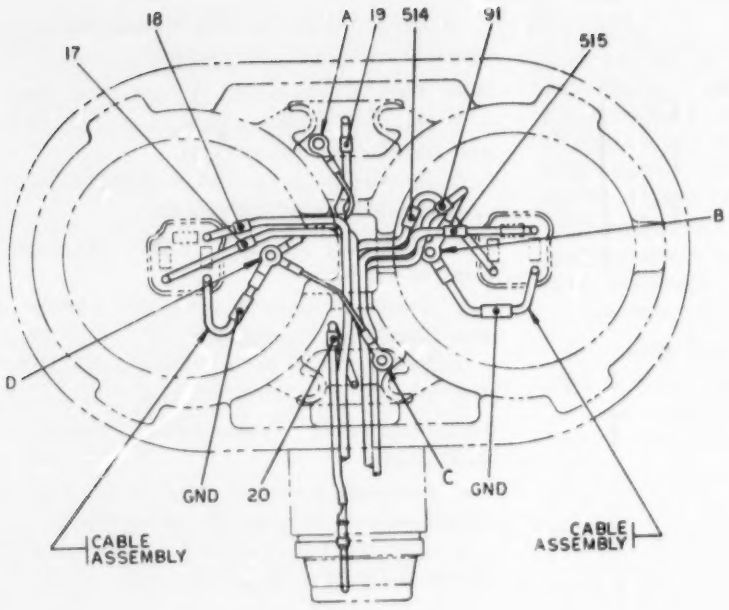
(*e*) Wrap splices and wrap cables into harness bundle with tape. Use plastic electrical insulation tape and bind cables together with one half overlapping turns in the same manner that the old harness was wrapped.

(*f*) Locate the attach required circuit number and part number markers, using the old harness as a pattern.

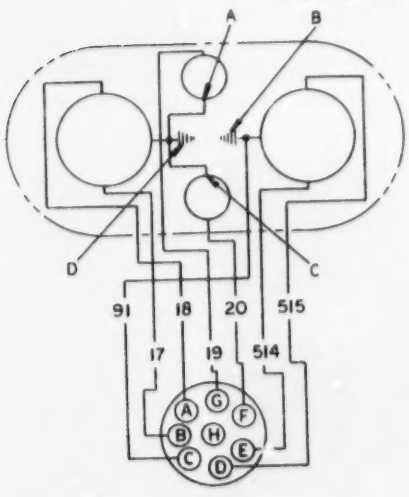
f. Test. The test of a wiring harness is performed during assembly.

3-49. Front Headlamp Assembly

a. Disassembly. Refer to TM 9-2350-256-20 for removal, installation and service of the front headlamp assembly. Refer to figure 3-21 to remove the wiring harness and gound cables. Paragraph 3-48 provides instructions for wiring harness repairs.



INTERNAL WIRING



SCHEMATIC DIAGRAM

CIRCUIT LEGEND
91 - GROUND
17 - HIGH BEAM CLEAR
18 - LOW BEAM CLEAR
19 - BLACK OUT DRIVING
20 - BLACK OUT MARKER
514 - BLACK OUT HIGH BEAM - IR
515 - BLACK OUT LOW BEAM - IR

TA016005

Figure 3-21. Front headlamp assembly—internal wiring.

b. Assembly. Install the wiring harness and ground cables in reverse order of removal. Refer to figure 3-21 for cable attachment identification.

Section IX. REPAIR OF HYDRAULIC COMPONENTS

3-50. Description

The hydraulic system is comprised of an operating boom, main winch, hoist winch, spade and associated valves and subassemblies. This system is powered by the main hydraulic pump which is driven by the mechanical transmission. The transmission derives its power through the power takeoff (PTO) shaft coupled to the front end of the engine. The auxiliary hydraulic system provides supplementary power for auxiliary equipment operation and emergency power to assist in recovery operations.

3-51. Main Winch and Hoist Winch Cables

a. Removal. Refer to paragraphs 2-22 and 2-23 for removal and installation instructions.

b. Repair. Refer to TM 9-2350-256-34-2 for inspection and repair instructions.

3-52. Hoisting Boom

a. Removal. Refer to paragraph 2-24 for removal and installation instructions.

b. Repair. Refer to TM 9-2350-256-34-2 for inspection and repair instructions.

3-53. Main Winch and Spade Assembly

a. Removal. Refer to paragraph 2-25 for removal and installation instructions.

b. Repair. Refer to TM 9-2350-256-34-2 for inspection and repair instructions.

3-54. Main Winch Level Winder Arm Assembly

a. Removal. Refer to paragraph 2-27 for removal and installation instructions.

b. Repair. Refer to TM 9-2350-256-34-2 for inspection and repair instructions.

3-55. Hydraulic Control Panel Assembly and Control Valves.

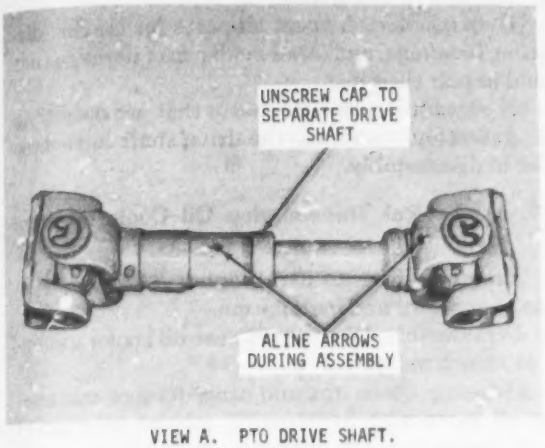
a. Removal. Refer to paragraph 2-30 for removal and installation instructions.

b. Repair. Refer to TM 9-2350-256-34-2 for inspection and repair instructions.

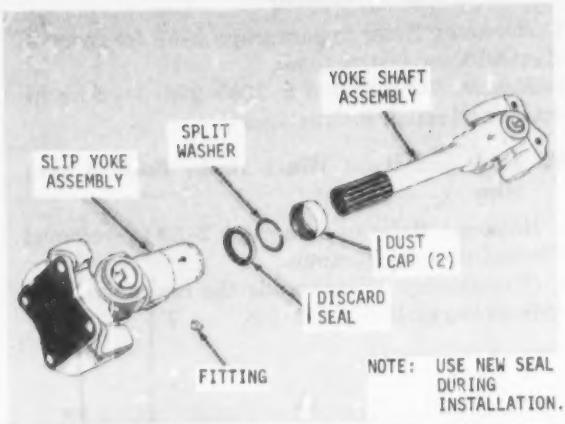
3-56. Mechanical Transmission Power Takeoff Drive Shaft

a. Removal. Refer to paragraph 2-31 for instructions on removing the drive shaft.

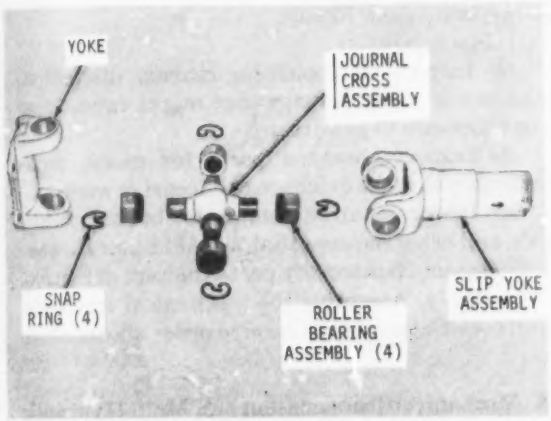
b. Disassembly. Disassemble the drive shaft as shown in figure 3-22.



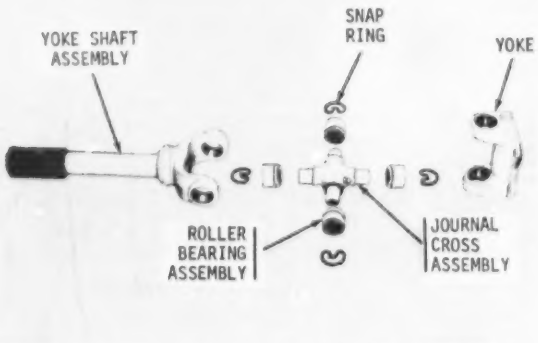
VIEW A. PTO DRIVE SHAFT.



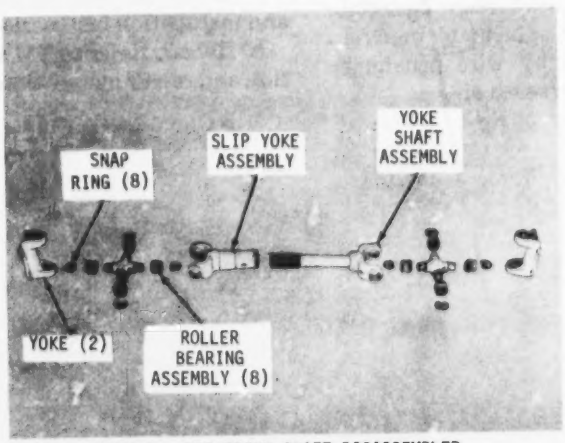
VIEW B. SEPARATION OF SLIP YOKE AND YOKE SHAFT ENDS.



VIEW C. JOURNAL CROSS ASSEMBLY - SLIP YOKE.



VIEW D. JOURNAL CROSS ASSEMBLY - YOKE SHAFT END.



VIEW E. PTO DRIVE SHAFT DISASSEMBLED.

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Figure 3-22. Mechanical transmission power takeoff drive shaft—disassembly and assembly.

3-59. Hoist Winch Assembly

a. Removal. Refer to paragraph 2-35 for removal and installation instructions.

b. Repair. Refer to TM 9-2350-256-34-2 for inspection and repair instructions.

3-60. Main and Hoist Winch Brake Band Assemblies

a. Removal. Refer to paragraph 2-39 for removal and installation instructions.

b. Disassembly. Disassemble the brake band assembly as shown in figure 3-24.

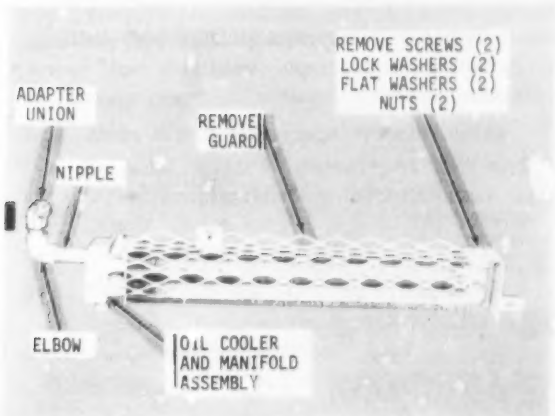

Figure 3-23. Mechanical transmission oil cooler assembly—disassembly and assembly.

c. Cleaning. Clean dirt and other foreign material from all parts with drycleaning solvent or mineral spirits paint thinner, followed by wire brushing where necessary. Dry with compressed air.

d. Inspection and Repair.

(1) *Inspection.* Inspect all parts for cracks, distortion, breakage, and other evidence of damage that would impair their use.

(2) *Repair.* Replace any parts that are defective.

e. Assembly. Assemble the drive shaft in reverse order of disassembly.

3-57. Mechanical Transmission Oil Cooler Assembly.

a. Removal. Refer to paragraph 2-33 for instructions on removal and installation.

b. Disassembly. Disassemble the oil cooler assembly as shown in figure 3-23.

c. Cleaning. Clean dirt and other foreign material from all parts with drycleaning solvent or mineral spirits paint thinner, followed by wire brushing where necessary. Dry with compressed air.

d. Inspection and Repair.

(1) *Inspection.*

(a) Inspect oil cooler for cracks, distortion, breakage, and other damage that might cause leakage or otherwise impair its use.

(b) Inspect threaded parts for nicks, cross threading, and other evidence of excessive wear.

(c) Inspect guard assembly for broken welds, cracks, and other damage that would impair its use.

(2) *Repair.* Replace any parts that are defective.

e. Assembly. Assemble the mechanical transmission oil cooler assembly in reverse order of disassembly.

3-58. Mechanical Transmission and Main Hydraulic Pump Assembly

a. Removal. Refer to paragraph 2-32 for removal and installation instructions.

b. Repair. Refer to TM 9-2350-256-34 for inspection and repair instructions.

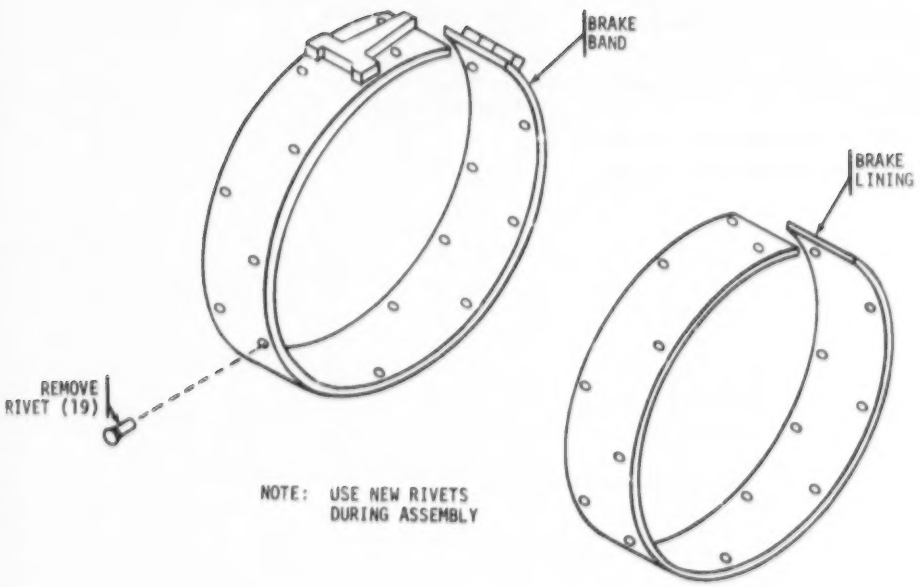

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Figure 3-24. Main and hoist winch brake band assembly—disassembly and assembly.

c. Cleaning. Clean brake band and brake drum surfaces with drycleaning solvent or mineral spirits paint thinner.

d. Inspection. Inspect the brake lining for wear and damage.

e. Repair. Replace worn or unserviceable brake linings or bands.

f. Assembly. Assemble the brake band assembly in reverse order of disassembly. Use new rivets (19 for each assembly) to hold the brake lining to the band.

3-61. Hydraulic System Oil Tank Assembly

a. Removal. Refer to paragraph 2-40 for removal and installation instructions.

b. Repair. Refer to TM 9-2350-256-34-2 for inspection and repair instructions.

3-62. Hydraulic Oil Tank Cover Assemblies and Suction Pipe

a. Removal. Refer to paragraph 2-43 for removal and installation instructions.

b. Repair. Refer to TM 9-2350-256-34-2 for inspection and repair instructions. Replace the suction pipe if defective.

3-63. Pressure Switch

a. Removal. Refer to TM 9-2350-256-20 for removal and installation instructions.

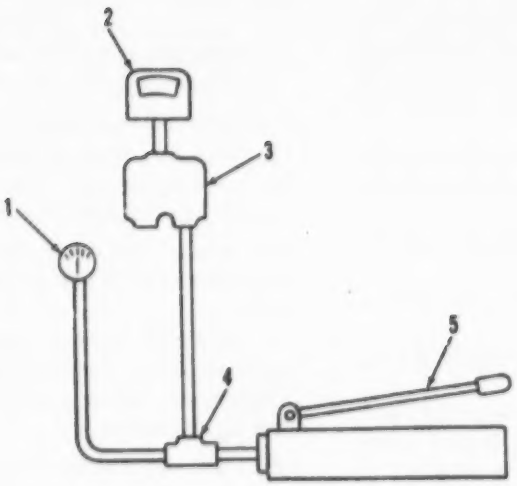
b. Tests and Adjustments.

(1) *General.* The switch should open when hydraulic pressure of 235 ± 3 psi is applied and should close when the pressure drops to approximately 221 ± 8 psi. Paragraphs 3-63*b*(2) and (3) contain instructions for testing and adjusting the pressure switch.

(2) *Test.*

(*a*) Connect the pressure switch to the porta-power pump and pressure gage and connect an ohmmeter to the two electrical leads on the pressure switch as shown in figure 3-25.

Legend for fig. 3-25:
1 Pressure gage (7950330)
2 Ohmmeter
3 Pressure switch
4 Tee fitting
5 Porta-power pump



TA016007

Figure 3-25. Pressure switch assembly test arrangement.

NOTE

Ohmmeter shall read "0" ohms with no hydraulic pressure applied. If ohmmeter does not read "0", replace the pressure switch and perform the test and adjustment procedure on a new pressure switch.

(*b*) Actuate pump and slowly raise pressure to 235 ± 3 psi while watching ohmmeter. The pressure switch should open (ohmmeter reads infinity) at this pressure. If it does not or if it opens before this pressure is reached, adjust the pressure siwtch as instructed in paragraph 3-63(3).

(*c*) Slowly relieve pressure until switch closes (ohmmeter reads "0"). The pressure gage should read 221 ± 8 psi at this point. If it does not, replace switch and perform the test and adjustment procedure on a new pressure switch.

(*d*) Again raise the pressure slowly to 235 ± 3 psi to check repeatability of switch. It should open again at this pressure. If it does not, replace the switch and perform the test and adjustment procedure on a new pressure switch.

(*e*) Relieve pressure, disconnect test equipment and install pressure switch (TM 9-2350-256-20).

(3) *Adjustment.* Refer to paragraph 3-63*b*(1) and (2).

(*a*) Pressure switch has not opened when a pressure of 235 ± 3 psi is reached.

1 Loosen switch setscrew and apply 235 psi hydraulic pressure.

2 While maintaining pressure at 235 psi, slowly turn switch adjustment screw counterclockwise until the ohmmeter reads infinity. If switch cannot be adjusted in this manner, replace switch and perform the complete test and adjustment procedure on a new pressure switch.

3 Test action of switch by performing steps (c) and (d) of the test procedure above.

4 Tighten switch setscrew, relieve pressure, disconnect test equipment and install pressure switch (TM 9-2350-256-20).

(*b*) Pressure switch opens before a pressure of 235 ± 3 psi is reached.

1 Loosen switch setscrew and apply 23o psi hydraulic pressure.

2 While maintaining pressure at 235 psi, slowly turn switch adjustment screw clockwise until ohmmeter reads "0". If the ohmmeter does not read "0" when the adjustment screw is turned fully clockwise, replace switch and perform the complete test and adjustment procedure on a new switch.

3 Very slowly back off the adjustment screw (turn counterclockwise) until the ohmmeter reads infinity.

4 Test action of the switch by performing steps (c) and (d) of the test procedure.

5 Tighten switch setscrew, relieve pressure, disconnect test equipment and install pressure switch (TM 9-2350-256-20).

3-64. Spade Subplate and Control Valve Assembly

a. Removal. Refer to paragraph 2-46*f* for removal and installation instructions.

b. Repair. Refer to TM 9-2350-256-34-2 for inspection and repair instructions.

3-65. Flow Regulating Subplate Assembly

a. Removal. Refer to paragraph 2-46*h* for removal and installation instructions.

b. Repair. Refer to TM 9-2350-256-34-2 for inspection and repair instructions.

3-66. Main Winch Motor

a. Removal. Refer to paragraph 2-26 for removal and installation instructions.

b. Repair. Replace the motor if it is defective.

3-67. Hoist Winch Motor

a. Removal. Refer to paragraph 2-37 for removal and installation instructions.

b. Repair. Replace the motor if it is defective.

3-68. Boom and Stayline Actuating Cylinder Assemblies and Stayline Actuating Cylinder Crank Arms

a. Removal. Refer to paragraph 2-29 for removal and installation instructions.

b. Repair. Replace cylinders and crank arms if they are defective.

3-69. Main Hydraulic Pump Unloading Valve

a. Removal. Refer to paragraph 2-34 for removal and installation instructions.

b. Repair. Replace the valve if it is defective.

3-70. Hoist Winch Counterbalance Valve

a. Removal. Refer to paragraph 2-36 for removal and installation instructions.

b. Repair. Replace the valve if it is defective.

3-71. Main Winch and Hoist Winch Brake Cylinders

a. Removal. Refer to paragraph 2-38 for removal and installation instructions.

b. Repair. Replace the cylinders if they are defective.

3-72. Hydraulic System Oil Filter

a. Removal. Refer to paragraph 2-41 for removal and installation instructions.

b. Repair. Replace the filter if it is unserviceable.

3-73. Hydraulic Oil Tank Strainer (Filter)

a. Removal. Refer to paragraph 2-42 for removal and installation instructions.

b. Repair. Replace the strainer if it is damaged and unserviceable.

3-74. Fuel Transfer Pump and Auxiliary Hydraulic Motor Assembly

a. Removal. Refer to paragraph 2-45 for removal and installation instructions.

b. Repair. Replace the pump, motor and associated parts which are unserviceable.

3-75. Lines and Fittings

a. Removal. Refer to paragraph 2-46*b* for removal and installation instructions.

b. Repair. Replace parts that are damaged, worn or otherwise unserviceable.

3-76. Fuel Transfer Pump and Auxiliary Hydraulic Motor Assembly Motor Control Valve

a. Removal. Refer to paragraph 2-46*d* for removal and installation instructions.

b. Repair. Replace the valve if it is defective.

3-77. Spade Cable Control Assembly

a. Removal. Refer to paragraph 2-46*g* for removal and installation instructions.

b. Repair. Replace any parts that are damaged and unserviceable.

3-78. Boom Limit Pilot Valves

a. Removal. Refer to paragraph 2-46*i* for removal and installation instructions.

b. Repair. Replace the valves if they are defective.

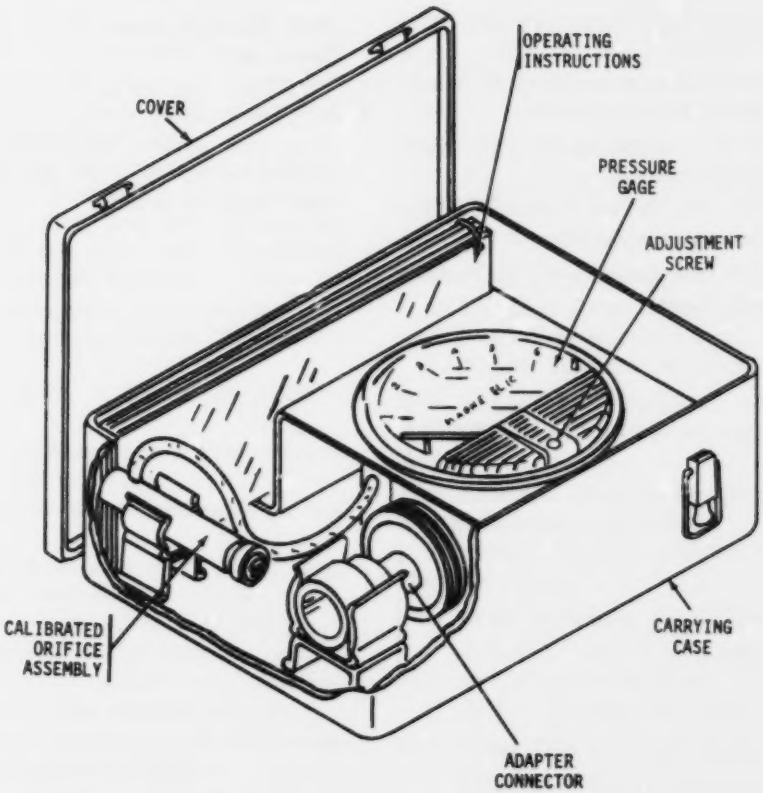
3-79. Hydraulic Hose Connecting Panel Assembly

a. Removal. Refer to paragraph 2-46*j* for removal and installation instructions.

b. Repair. Replace the connecting panel if it is damaged and unserviceable.

3-80. Gas-Particulate Filter Unit—Test and Adjustment

a. Test. Use the airflow tester (NSN 6680-00-436-4212) (ref. table 2-1) when testing the gas-particulate filter unit airflow. Operating instructions for the airflow tester (fig. 3-26) are packed in the carrying case with the tester.



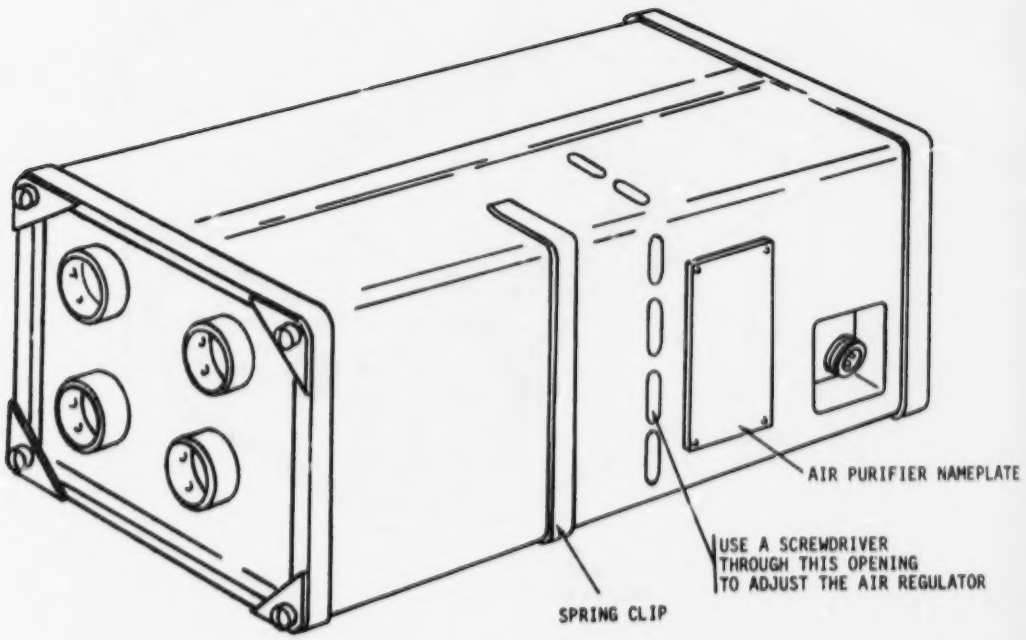
TA016008

Figure 3-26. Gas-particulate filter unit airflow tester.

b. Adjustment. Use a screwdriver to adjust the airflow by opening the filter unit air regulator (fig. 3-27). Turn clockwise to close and counterclockwise to open.

NOTE

Some filter unit precleaners do not have an adjustable air regulator. If airflow cannot be adjusted to between 3 and 4½ cfm, the purifier assembly must be replaced.



TA016009

Figure 3-27. Gas-particulate filter unit—test and adjust.

CHAPTER 4

MAINTENANCE OF MATERIEL USED IN CONJUNCTION WITH MAJOR ITEM

Section I. AUXILIARY POWER UNIT

4-1. Description

a. General. The auxiliary power unit (fig. 4-1) consists of an air-cooled diesel engine with a chain case, generator (which is also used as a starter), and hydraulic pump mounted to it. The chain case covers three sprockets and a drive chain. With a support and mounts, the engine, generator/starter and pump form a compact unit which fits into the right forward corner of the vehicle engine compartment. The generator electrical system is designed to supply a maximum of approximately 150 amperes of current at approximately 28 volts dc to charge the vehicle batteires. The pump supplies pressure at 2000 ± 50 psi to the auxiliary hydraulic system.

Legend for fig. 4-1:

1 Engine combustion air inlet
2 Exhaust tube
3 Governor speed adjustment screw
4 Crankcase oil gage rod
5 Auxiliary generator cooling duct
6 Auxiliary generator
7 Support and mount
8 Fuel injection nozzle tubes
9 Lifting eye
10 Fuel injection pump
11 Panel
12 Oil pressure sending unit
13 Retainer
14 Oil filter
15 Low oil pressure switch
16 Crankcase oil drain valve
17 Fuel line
18 Fuel line connections
19 Fuel pump filter bowl
20 Fuel transfer pump
21 Engine cooling air outlet duct
22 Access cover
23 Lead to high air temperature warning light switch
24 Accessory drive case
25 Accessory drive case vent
26 Hydraulic hose connection
27 Accessory drive case oil fill
28 Ground cable
29 Accessory drive case oil drain
30 Hydraulic hose
31 Wiring harness
32 Auxiliary hydraulic pump
33 Starter relay

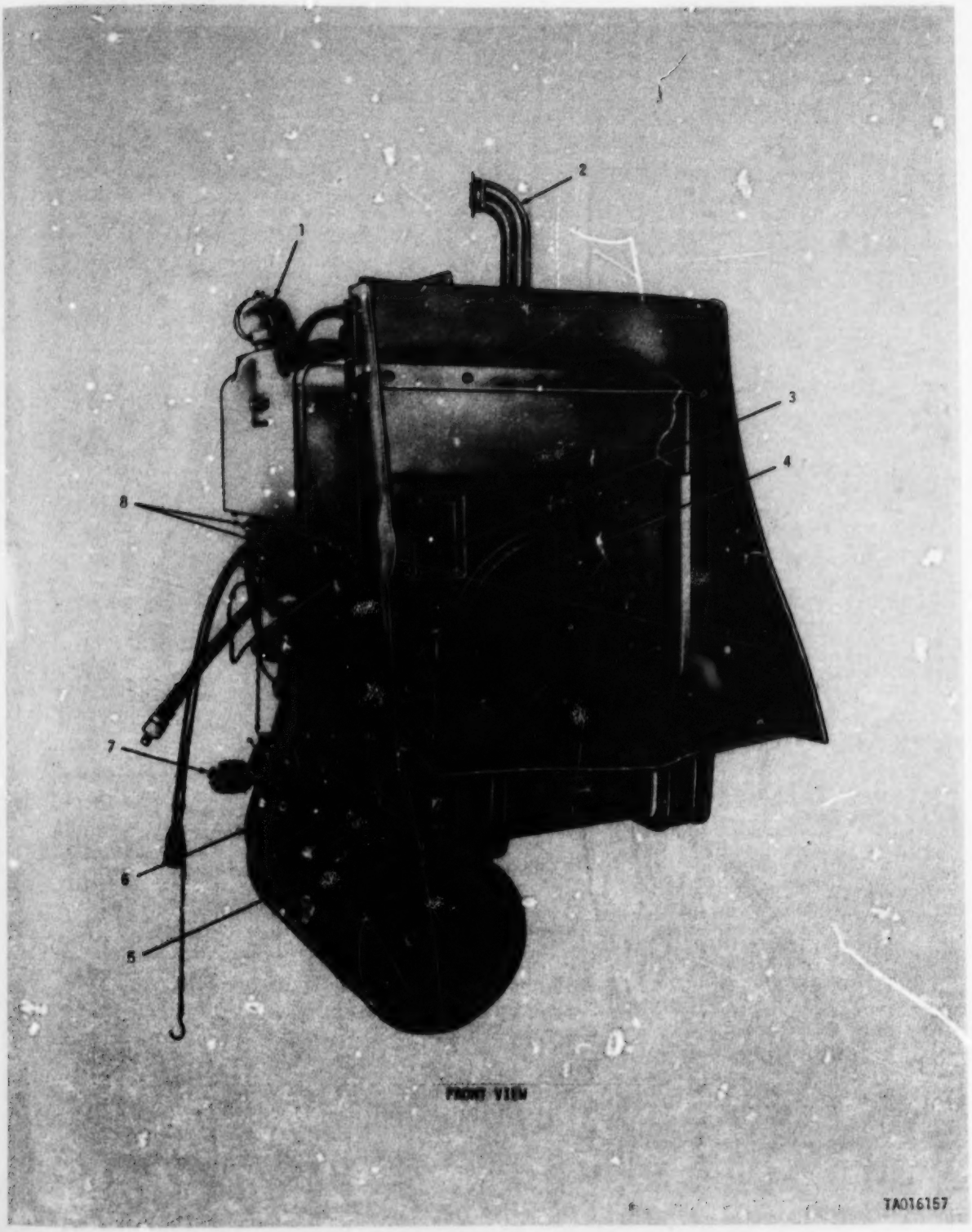


Figure 4-1. Auxiliary power unit (Sheet 1 of 3).

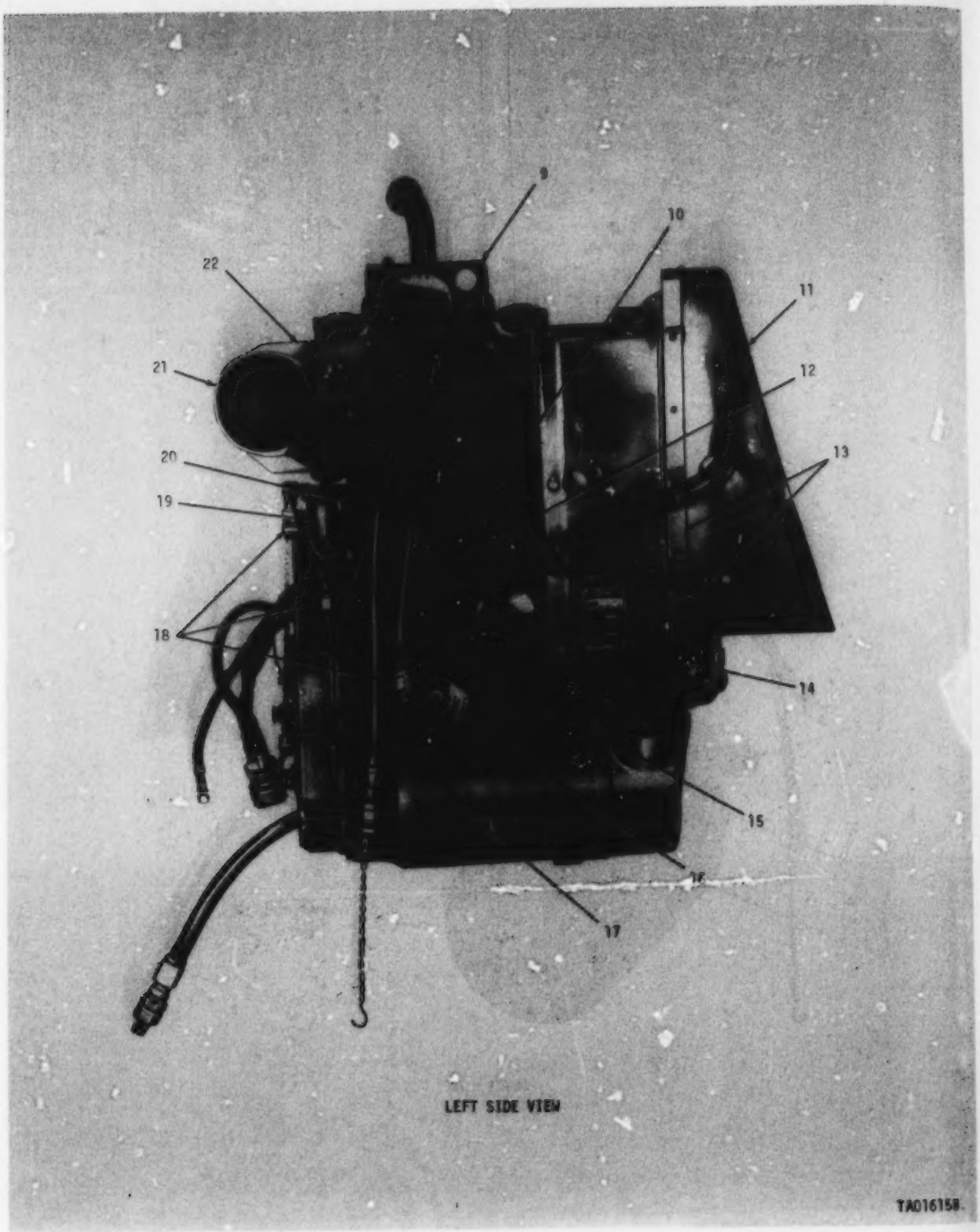
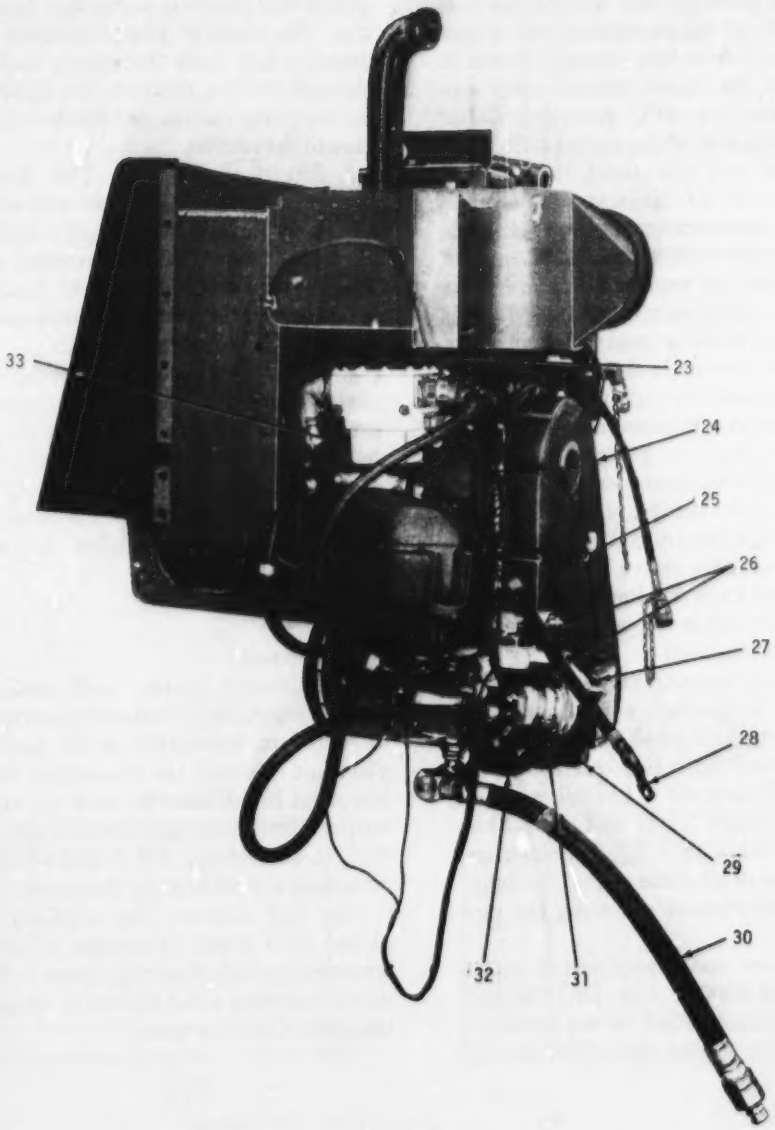


Figure 4-1. Auxiliary power unit (Sheet 2 of 3).



RIGHT REAR VIEW

TA039290

Figure 4-1. Auxiliary power unit (Sheet 3 of 3).

b. Starting System. The generator, which is coupled to the engine by a drive chain, also serves the dual role as a starter. When the preheat switch is held in the closed (ON) position, and the generator switch is open (OFF), one side of the preheat relay energizing coil on the APU engine is grounded through the preheat switch and a set of APU generator switching relay contacts. This causes the preheat relay contacts to close since the opposite side of the energizing coil is connected directly to the vehicle bus voltage. Power is then supplied through the closed preheat relay contacts to the preheaters, the APU generator/starter field winding, and to one side of the starter switch circuit. When the starter switch is closed, it completes the APU starter relay coil circuit, and bus power is supplied to the APU generator/starter armature circuit through these relay contacts, thus motorizing the generator/starter to start the engine. Therefore, both the preheat and starter switches must be closed (ON), and the generator switch must be open (OFF), in order to start the APU. Since the preheat relay energizing coil ground circuit is passed through the set of APU switching relay contacts (as mentioned above), the preheat relay cannot activate if the generator switch is on. The reason for this circuit arrangement is to prevent vehicle bus voltage from being applied to the voltage regulator field through the preheat relay contacts, thus damaging the regulator when the generator switch is on (field circuit from generator to regulator closed) and the preheat switch is activated (bus voltage applies to generator field winding).

c. Lubrication. A gear-type pump draws oil from the crankcase and delivers it through a replaceable oil filter to the engine. Normal oil pressure should be 25 psi or higher under normal operating conditions. An oil pressure switch will activate a low oil pressure warning light on the auxiliary power unit control box if the oil pressure drops below 14 ± 2 psi. A crankcase drain valve is provided with a handle so that the lubricating oil can be drained without removing the unit from the vehicle.

d. Governor. A constant speed governor is set to maintain engine speed at 2000 ± 100 rpm. The governor uses a ball and cup mechanism on the camshaft gear as the sensing device. A yoke resting on the cup connects to an arm and spring mechanism controlling the trottle lever. Any change in engine speed is transmitted from the cup to the yoke and to the throttle. An adjusting screw is provided on the front of the unit to adjust the speed by changing the spring tension.

e. Fuel system. The fuel system consists basically of a primary and secondary fuel filter, fuel transfer pump, fuel injection pump and two fuel injection nozzles. The transfer pump operates off the camshaft, drawing fuel from the supply tank and delivering it through the two filters to the injection pump. The injection pump meters and delivers the fuel at high pressure to the nozzles.

f. Electrical System. The generator/starter is mounted to the chain case and engine housing and driven by the engine through a roller chain and drive sprocket. The output is controlled automatically by a voltage regulator and current limiting device. A detailed description of the auxiliary generating system is contained in paragraph 1-3*g*(2).

g. Hydraulic System. The pump is mounted to the chain case and driven by the engine. It supplies the pressure for the auxiliary hydraulic system. This system powers the refuel pump and impact wrench and also supplies power for emergency operation of the boom, spade and winches. A detailed description of the auxiliary hydraulic system is contained in TM 9-2350-256-34-2.

4-2. Repair

a. General.

(1) *Current limiter calibration.* Whenever the auxiliary generator, voltage regulator, APU assembly, or relay box, is replaced or the auxiliary engine is replaced or repaired, the rheostat in the switching relay box must be adjusted to limit the auxiliary generator output current to approximately 150 amperes with the APU in the vehicle. TM 9-2350-256-20 provides instructions for calibrating the current limiter.

(2) *Test fixture.* The auxiliary engine must be placed on a stand to operate it outside the vehicle (groundhopping). Refer to figure 4-2 for information on constructing a test fixture to support the APU during groundhopping tests.

Legend for figure 4-2:

Item	Name	Qty	Size (inches)	Material
1	Base angle	2	2.00 x 2.00 x 0.25 x 27.44 lg	steel
2	Base angle	2	2.00 x 2.00 x 0.25 x 24.75 lg	steel
3	Support angle	2	2.00 x 2.00 x 0.25 x 23.06 lg	steel
4	Support angle	2	2.00 x 2.00 x 0.25 x 28.25 lg	steel
5	Support angle	1	2.00 x 2.00 x 0.25 x 19.38 lg	steel
6	Support angle	3	2.00 x 2.00 x 0.25 x 20.10 lg	steel
7	Gusset	4	0.25 x 1.75 x 1.75 lg	hr steel
8	Pad	2	0.75 x 3.00 x 2.88 lg	hr steel
9	Pad	1	0.75 x 2.25 x 2.00 lg	hr steel
10	Pad	1	0.75 x 2.25 x 3.00 lg	hr steel
11	Support angle	1	2.00 x 2.00 x 0.25 x 19.38 lg	steel

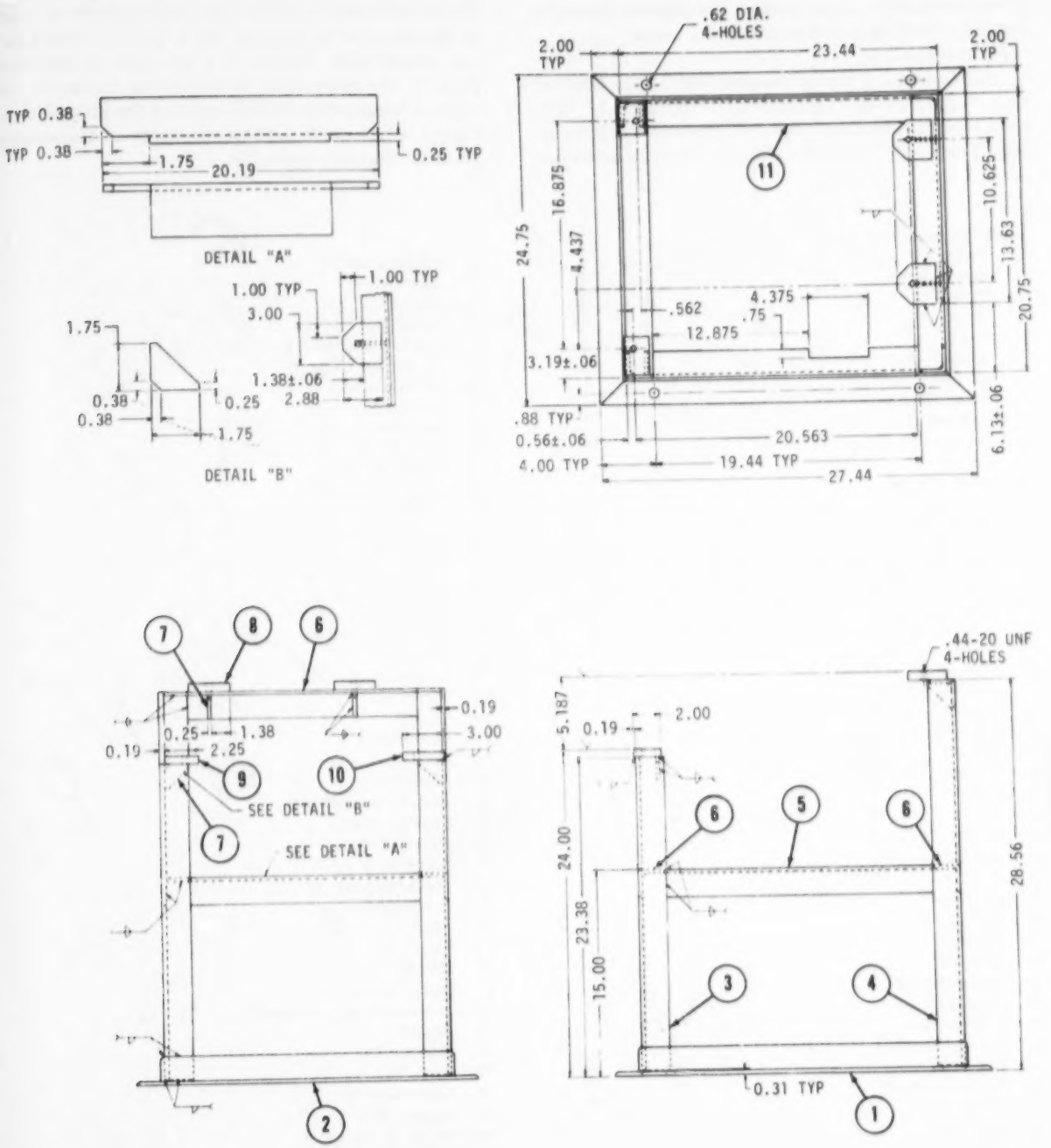


Figure 4-2. Test stand for auxiliary power unit.

(3) *Generator/starter brushes.* When replacing the generator/starter, or its brushes, the brushes should be sanded according to procedures in d.1 below.

b. Disassembly.

(1) *General.* Refer to paragraph 2-15 for removal and installation instructions. Refer to TM 9-2815-221-34&P for repair of the diesel engine assembly and to TM 9-2350-256-20 for components not covered in this manual. Figure 4-3 with legend identifies the components of the APU and provides an index to the step-by-step removal (fig 4-5) of each part during disassembly. Figure 4-4 provides a schematic guide to the connection of the wiring harnesses, the high air temperature switch lead and the ground leads. Figure 4-5.1, with legend, provides a disassembly guide for the relay assembly.

Legend for figure 4-3:

1 Screw (I)
2 Lockwasher (I)
3 Plate (K)
4 Bushing (K)
5 Key (K)
6 Sprocket (K)
7 Chain (K)
8 Screw (O)
9 Lockwasher (O)
10 Chain case (I, P)
11 Gasket
12 Drain tube (Q)
13 Clamp (R)
14 Washer (R)
15 Screw (R)
16 Flared tube connector (Q)
17 Coupling half (Q)
18 Coupling half (Q)
19 Retainer (Q)
20 Bushing (Q)
21 Hose assembly (C)
22 Coupling half (C)
23 Elbow (C)
24 Nipple (C)
24.1 Bracket
24.2 Washer
24.3 Screw
24.4 Nut
24.5 Washer
25 Adapter union (C)
26 Nipple (C)
27 Adapter (C)
28 Packing (C)
29 Pump (B)
30 Screw (B)
31 Lockwasher (B)
32 Packing (C)
33 Adapter (C)
34 Adapter union (C)
35 Elbow (C)
36 Pump adapter (Y)
37 Washer (W)
38 Screw (W)
38.1 U-Bolt
39 Tee (C)
40 Valve (C)
41 Adapter (C)
42 Coupling half (C)
43 Screw (W, Y)
44 Duct (N)
45 Generator (U)
46 Support strap (N)
47 Pin (N)
48 Cotter pin (N)
49 Bearing (Z)
50 Sprocket (Z)
51 Sprocket (Z)
52 Gasket (Z)
53 Bearing retainer (Y)
54 Oil seal (Z)
55 Stud (X)
56 Washer (Y)
57 Nut (V)
58 Sprocket plug (Z)
59 Sprocket (Z)
60 Lockwasher (H)
61 Screw (H)
62 Instruction plate (H)
63 Screw (H)
64 Plug (H)
65 Gasket (H)
66 Plug (H)
67 Elbow (H)
68 Breather assembly (H)
69 Chain cover (H)
70 Gasket (H)
71 Screw (R)
72 Lockwasher (R)
73 Retainer (R)
74 Panel (R)
75 Screw (D)
76 Duct (D)
77 Diesel engine (P, S)
78 Manufacturer's nameplate (R)
79 Panel (R)
80 Retainer (R)
81 Screw (S)
82 Lockwasher (S)
83 Support (S, T)
84 Mount (T)
85 Elbow (Q)
86 Coupling half (Q)
87 Coupling (Q)

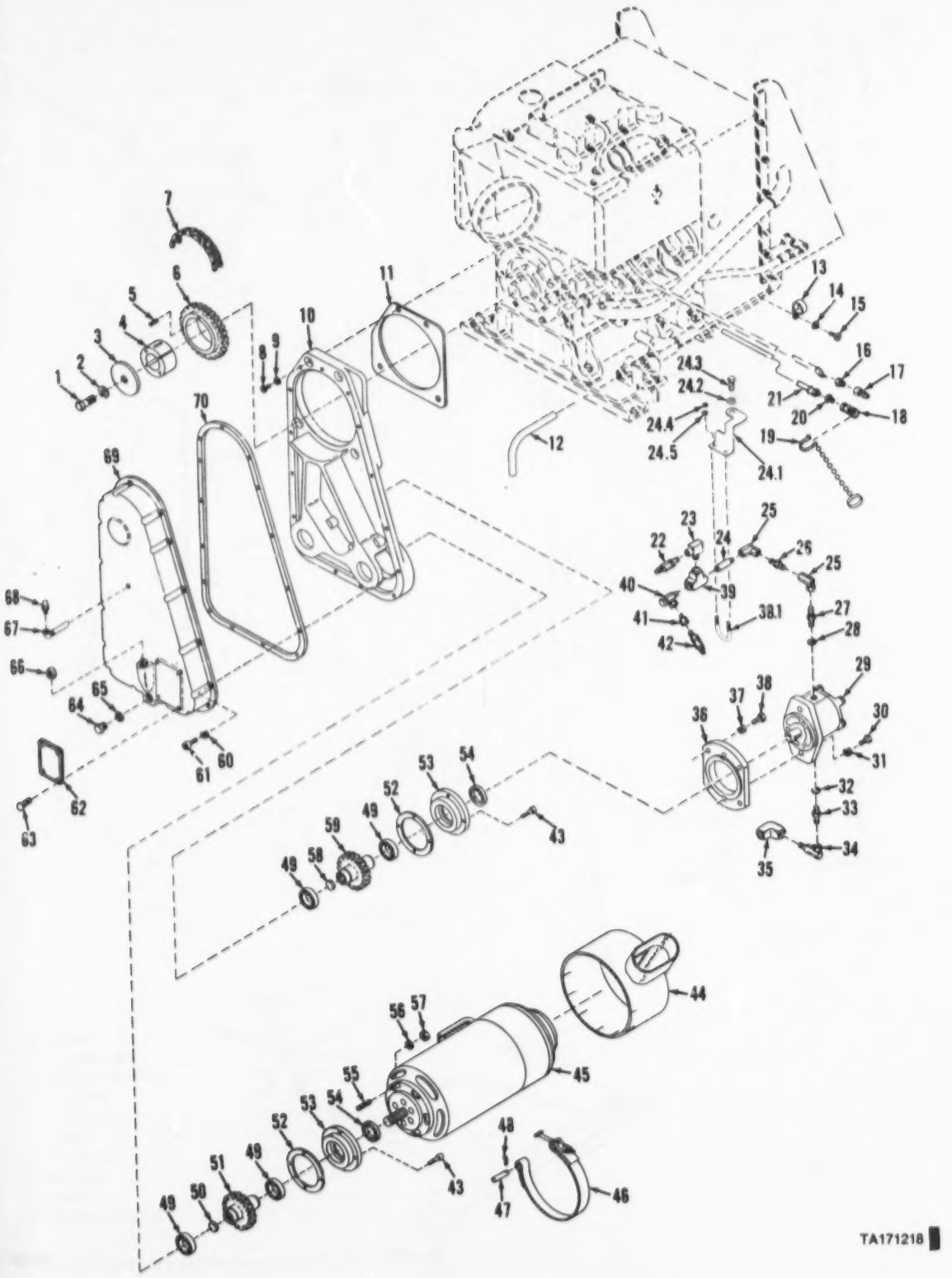


Figure 4-3. Auxiliary power unit—exploded view (Sheet 1 of 3).

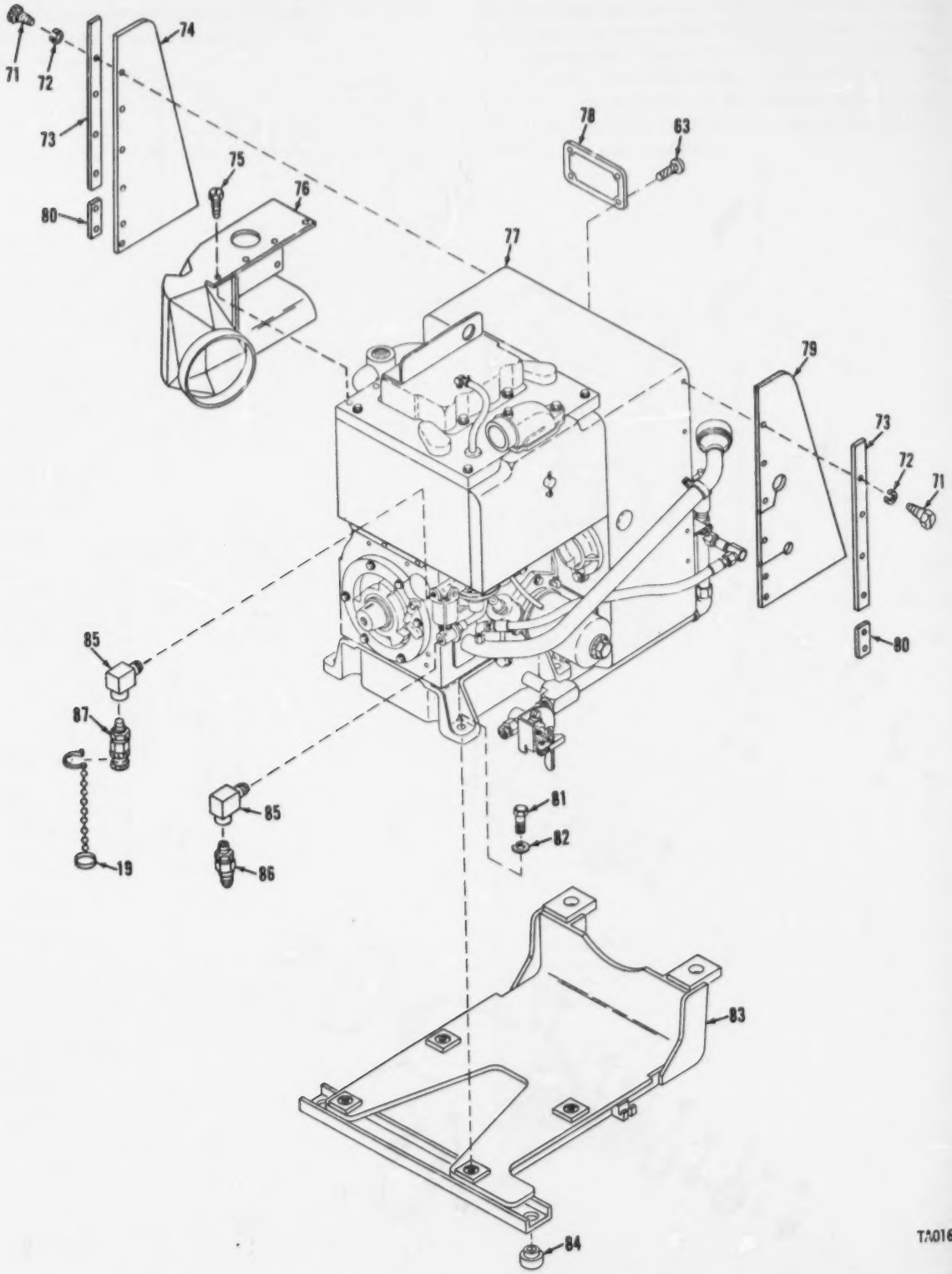
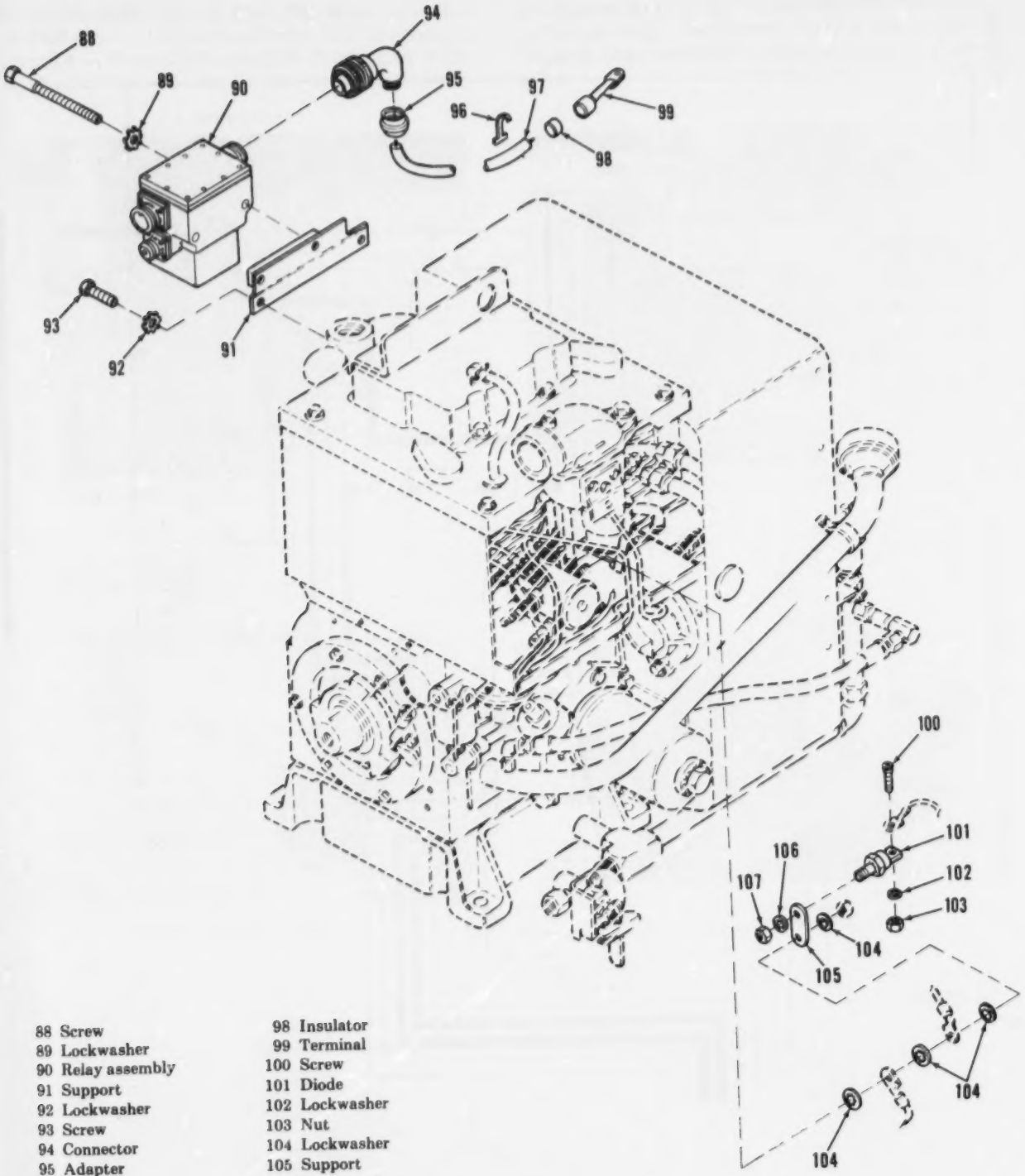


Figure 4-3. Auxiliary power unit—exploded view (Sheet 2 of 3).



88 Screw
89 Lockwasher
90 Relay assembly
91 Support
92 Lockwasher
93 Screw
94 Connector
95 Adapter
96 Band
97 Cable assembly
98 Insulator
99 Terminal
100 Screw
101 Diode
102 Lockwasher
103 Nut
104 Lockwasher
105 Support
106 Lockwasher
107 Nut

Note: The letters in parentheses refer to figure 4-5 view.

Figure 4-3. Auxiliary power unit—exploded view (Sheet 3 of 3).

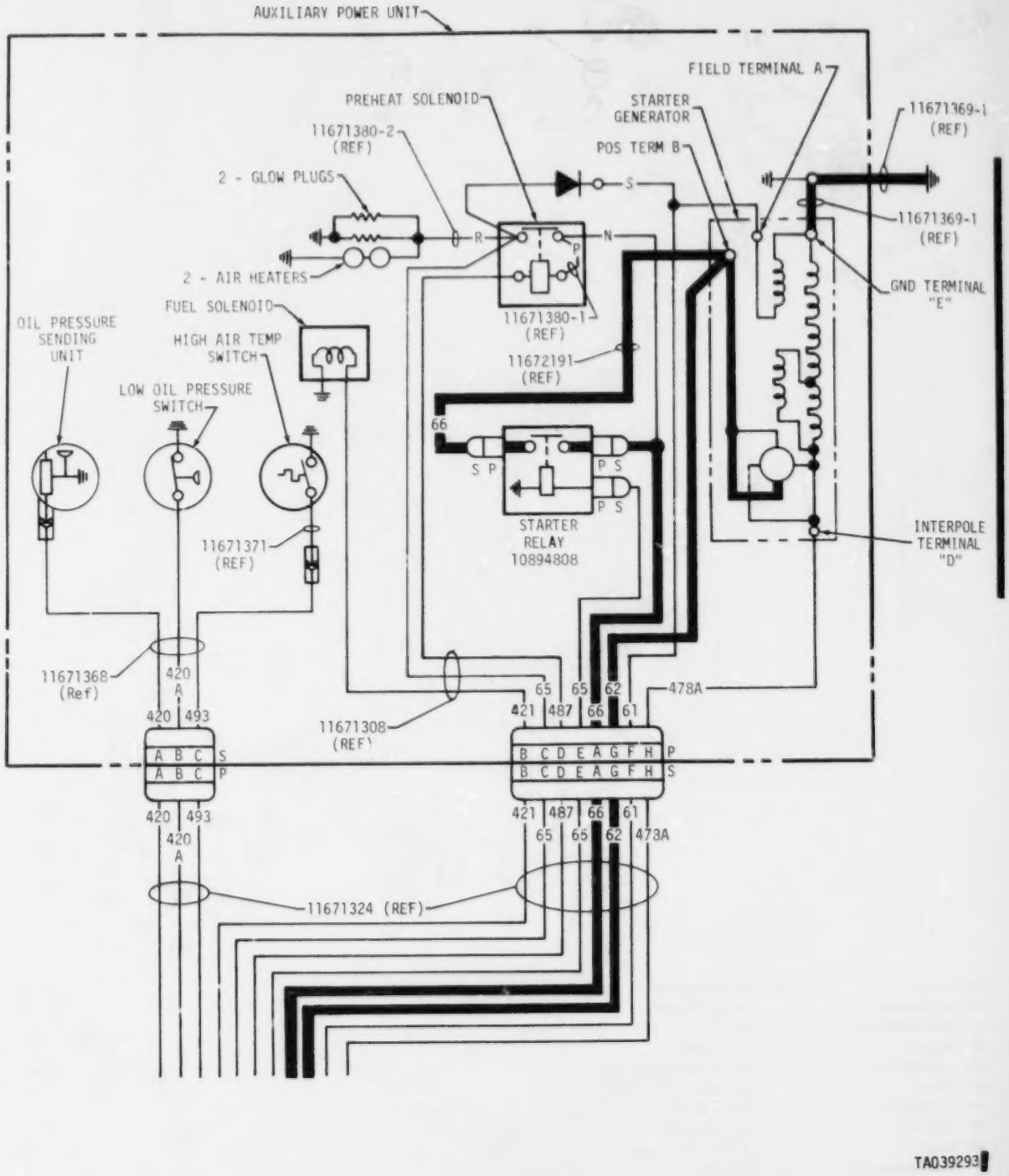
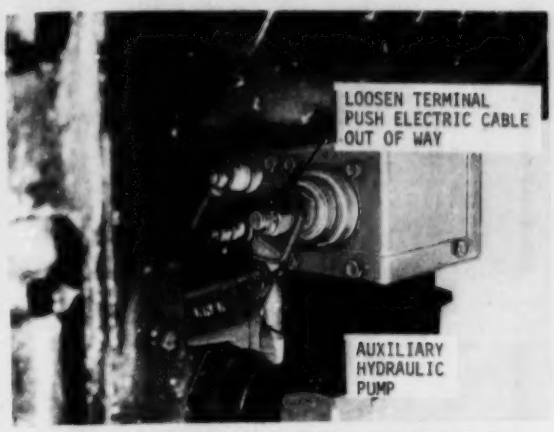
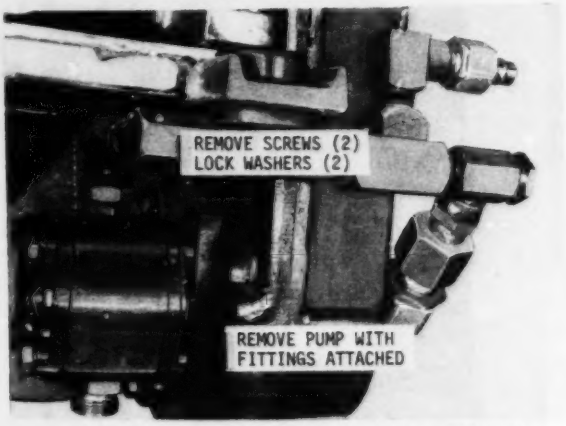


Figure 4-4. Auxiliary power unit wiring diagram.

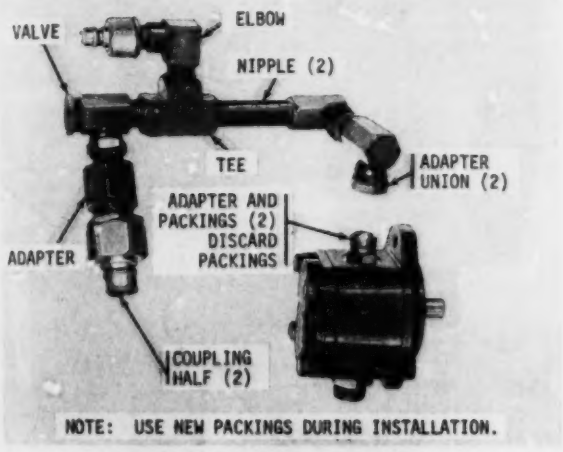
(2) *Procedure.* If the chain cover is to be removed, drain the oil from the chain case (LO 9-2350-256-12). Disassemble the APU as shown in figure 4-5. Refer to paragraph 3-48 for repair of the wiring harnesses. If the general condition of the individual cables, insulation and terminal connectors of a harness is such that repair becomes practically and economically inadvisable, replace the harness. Disassemble the relay assembly as shown in figure 4-5.1.



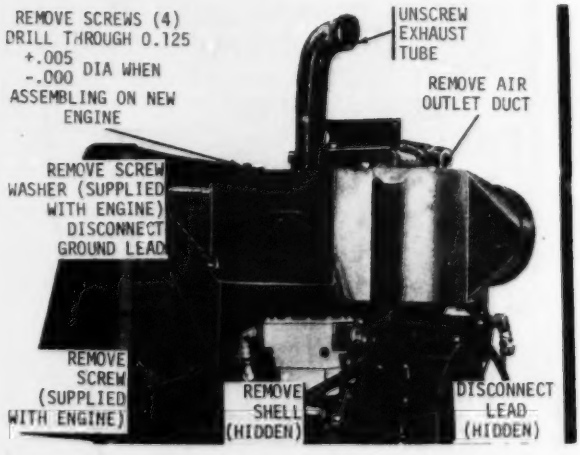
VIEW A. CLEARANCE FOR AUXILIARY HYDRAULIC PUMP.



VIEW B. AUXILIARY HYDRAULIC PUMP AND FITTINGS.



VIEW C. HYDRAULIC FITTINGS.



VIEW D. ENGINE COOLING AIR DUCTS.

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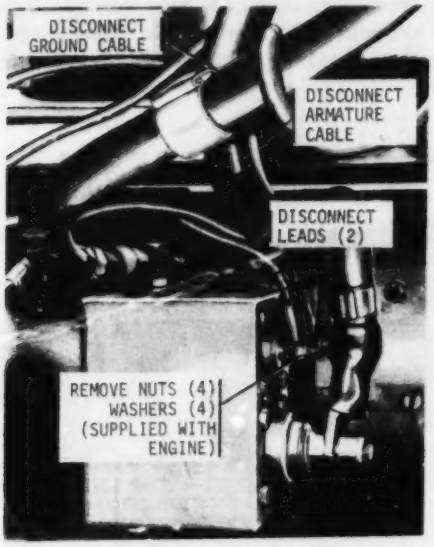
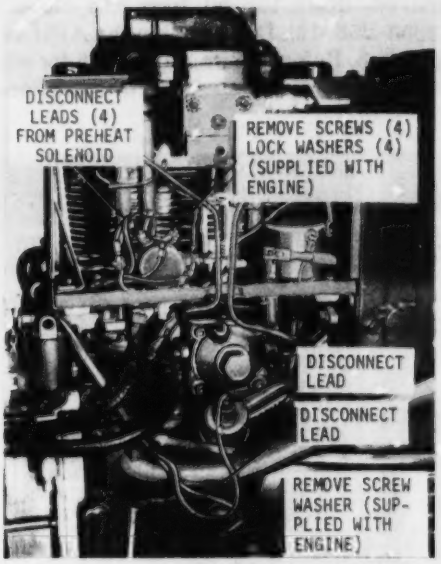
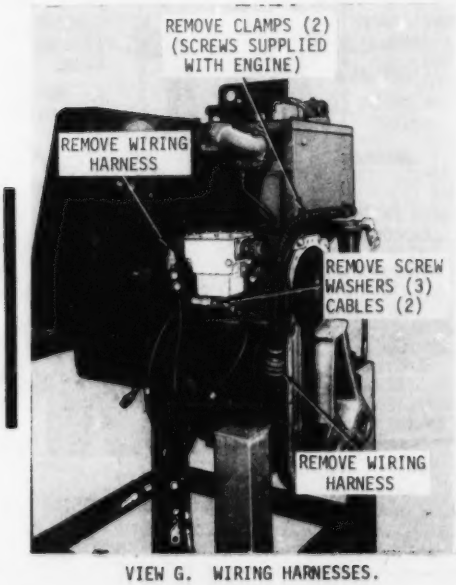
Figure 4-5. Auxiliary power unit—disassembly and assembly (Sheet 1 of 6).



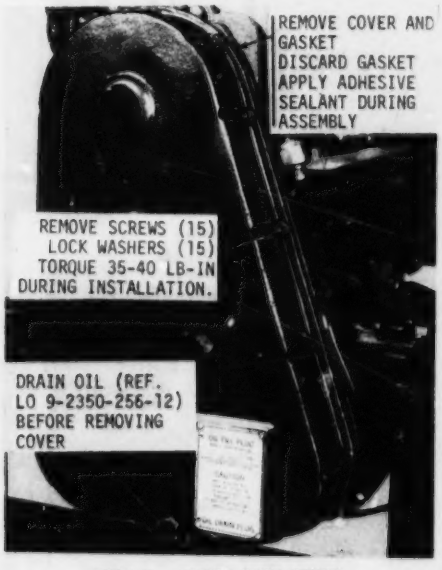
VIEW E. GENERATOR ELECTRICAL CONNECTIONS.


DISCONNECT LEADS (4) FROM PREHEAT SOLENOID
REMOVE SCREWS (4) LOCK WASHERS (4) (SUPPLIED WITH ENGINE)
DISCONNECT LEAD
DISCONNECT LEAD
REMOVE SCREW WASHER (SUPPLIED WITH ENGINE)

VIEW F. LEFT SIDE ELECTRICAL CONNECTIONS.


REMOVE CLAMPS (2) (SCREWS SUPPLIED WITH ENGINE)
REMOVE WIRING HARNESS
REMOVE SCREW WASHERS (3) CABLES (2)
REMOVE WIRING HARNESS

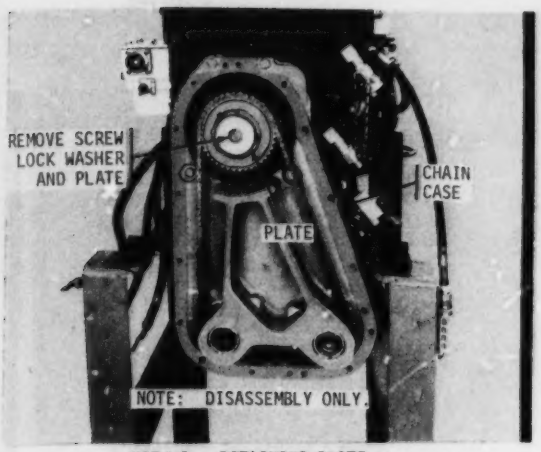
VIEW G. WIRING HARNESSES.


REMOVE COVER AND GASKET
DISCARD GASKET
APPLY ADHESIVE SEALANT DURING ASSEMBLY
REMOVE SCREWS (15) LOCK WASHERS (15) TORQUE 35-40 LB-IN DURING INSTALLATION.
DRAIN OIL (REF. LO 9-2350-256-12) BEFORE REMOVING COVER

VIEW H. CHAIN CASE COVER.

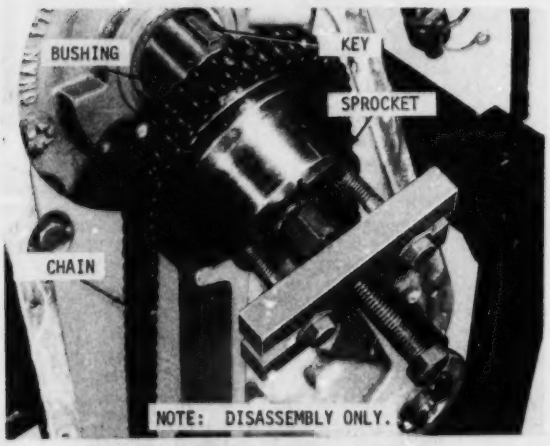
TA039295

Figure 4-5. Auxiliary power unit—disassembly and assembly (Sheet 2 of 6).

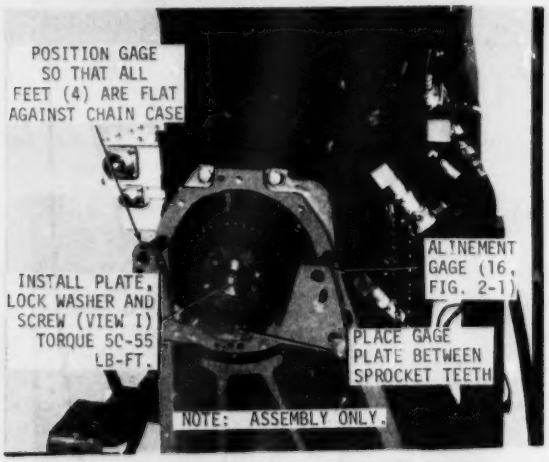


VIEW I. RETAINING PLATE.

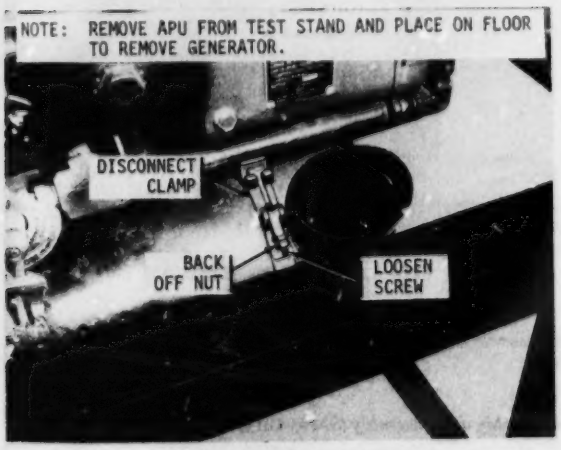
VIEW J. INSTALL PULLER.



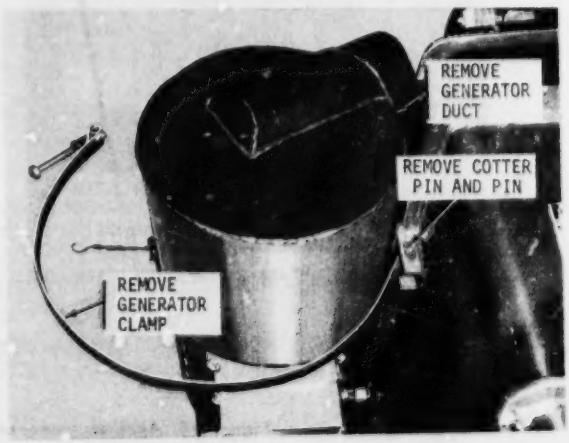
VIEW K. REMOVING SPROCKET AND CHAIN.


POSITION GAGE SO THAT ALL FEET (4) ARE FLAT AGAINST CHAIN CASE
ALINEMENT GAGE (16, FIG. 2-1)
INSTALL PLATE, LOCK WASHER AND SCREW (VIEW I) TORQUE 50-55 LB-FT.
PLACE GAGE PLATE BETWEEN SPROCKET TEETH
NOTE: ASSEMBLY ONLY.

VIEW L. ALINING SPROCKET AND CHAIN.



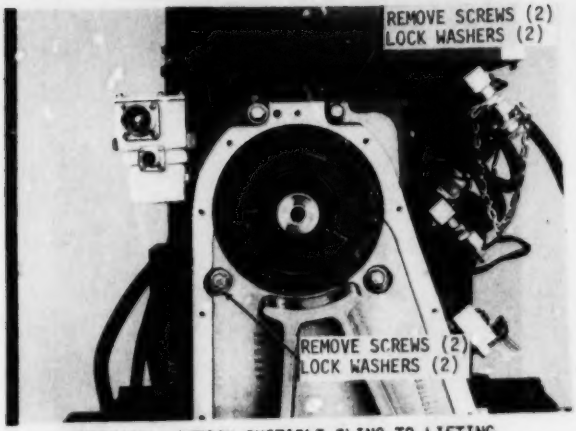
VIEW M. GENERATOR CLAMP.



VIEW N. GENERATOR CLAMP AND DUCT.

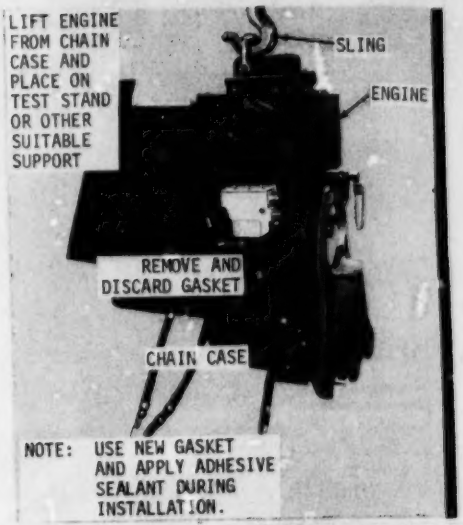
TA039296

Figure 4-5. Auxiliary power unit—disassembly and assembly (Sheet 3 of 6).

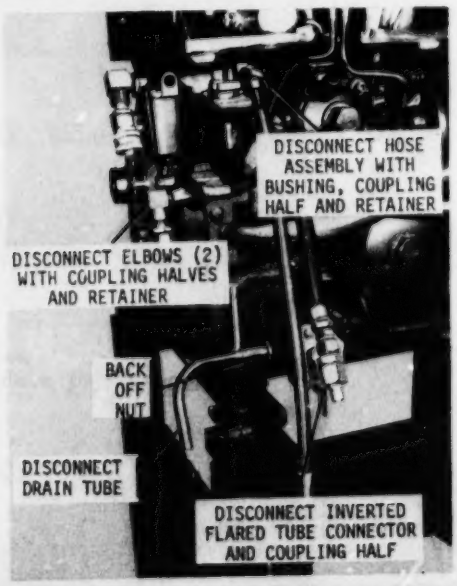


CAUTION: ATTACH SUITABLE SLING TO LIFTING EYE TO SUPPORT WEIGHT OF ENGINE WHILE REMOVING SCREWS.

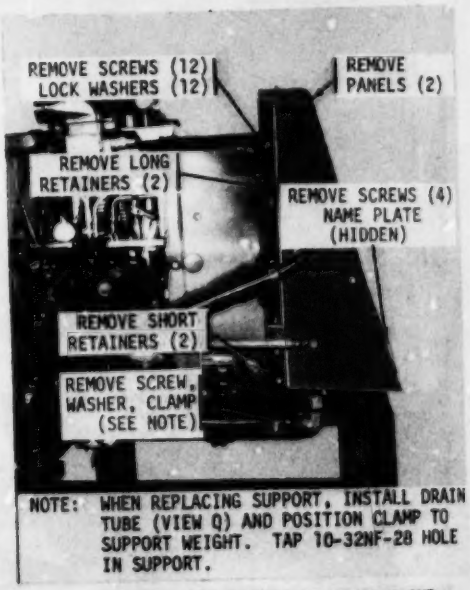
VIEW O. SEPARATION OF ENGINE FROM CHAIN CASE AND GENERATOR.


LIFT ENGINE FROM CHAIN CASE AND PLACE ON TEST STAND OR OTHER SUITABLE SUPPORT
SLING
ENGINE
REMOVE AND DISCARD GASKET
CHAIN CASE
NOTE: USE NEW GASKET AND APPLY ADHESIVE SEALANT DURING INSTALLATION.

VIEW P. SEPARATION OF ENGINE FROM CHAIN CASE AND GENERATOR.


DISCONNECT HOSE ASSEMBLY WITH BUSHING, COUPLING HALF AND RETAINER
DISCONNECT ELBOWS (2) WITH COUPLING HALVES AND RETAINER
BACK OFF NUT
DISCONNECT DRAIN TUBE
DISCONNECT INVERTED FLARED TUBE CONNECTOR AND COUPLING HALF

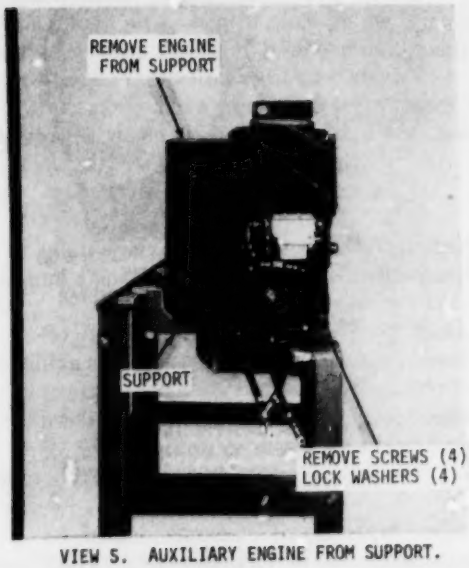
VIEW Q. FUEL LINE CONNECTIONS AND DRAIN TUBE.


REMOVE SCREWS (12)
LOCK WASHERS (12)
REMOVE PANELS (2)
REMOVE LONG RETAINERS (2)
REMOVE SCREWS (4) NAME PLATE (HIDDEN)
REMOVE SHORT RETAINERS (2)
REMOVE SCREW, WASHER, CLAMP (SEE NOTE)
NOTE: WHEN REPLACING SUPPORT, INSTALL DRAIN TUBE (VIEW Q) AND POSITION CLAMP TO SUPPORT WEIGHT. TAP 10-32NF-2B HOLE IN SUPPORT.

VIEW R. PANELS AND CRANKCASE DRAIN CLAMP.

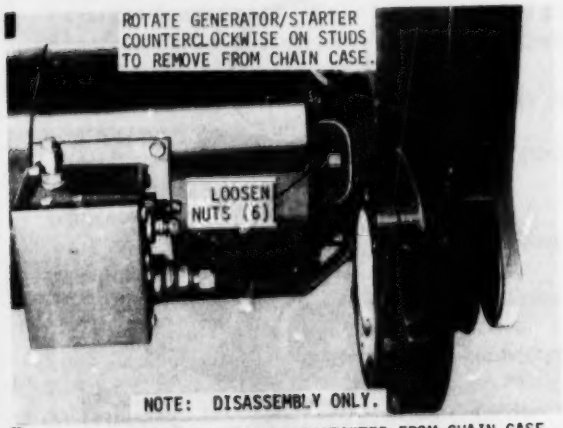
TA039297

Figure 4-5. Auxiliary power unit—disassembly and assembly (Sheet 4 of 6).

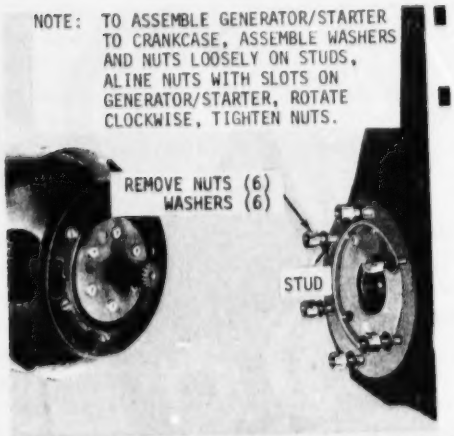


VIEW S. AUXILIARY ENGINE FROM SUPPORT.

VIEW T. APU SUPPORT AND MOUNTS.



VIEW U. SEPARATING GENERATOR/STARTER FROM CHAIN CASE.

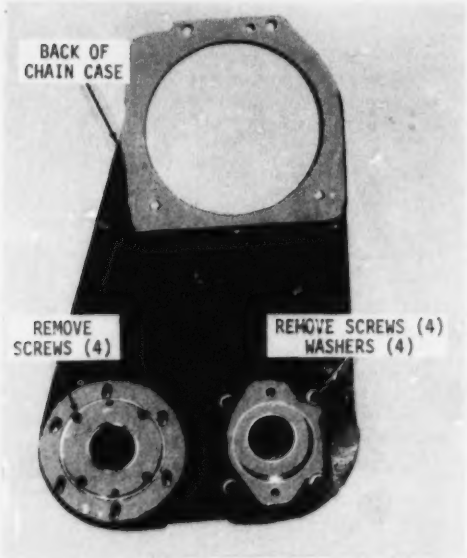

NOTE: TO ASSEMBLE GENERATOR/STARTER TO CRANKCASE, ASSEMBLE WASHERS AND NUTS LOOSELY ON STUDS, ALINE NUTS WITH SLOTS ON GENERATOR/STARTER, ROTATE CLOCKWISE, TIGHTEN NUTS.
REMOVE NUTS (6)
WASHERS (6)
STUD

VIEW V. NUTS, WASHERS AND ASSEMBLING GENERATOR/ STARTER TO CHAIN CASE.

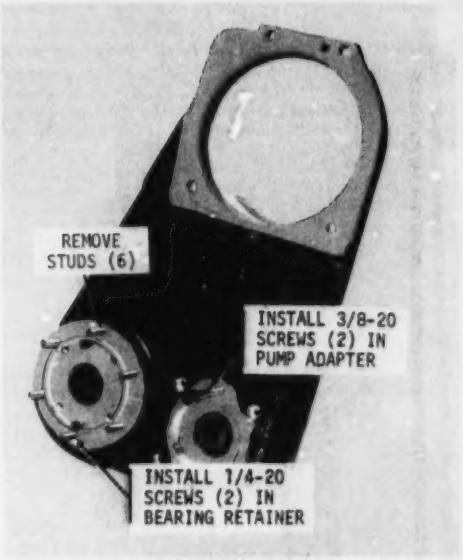
NOTE: WHEN REPLACING THE GENERATOR/STARTER, OR ITS BRUSHES, SAND THE BRUSHES ACCORDING TO PROCEDURES IN PARAGRAPH 4-2d.1.

TA039298

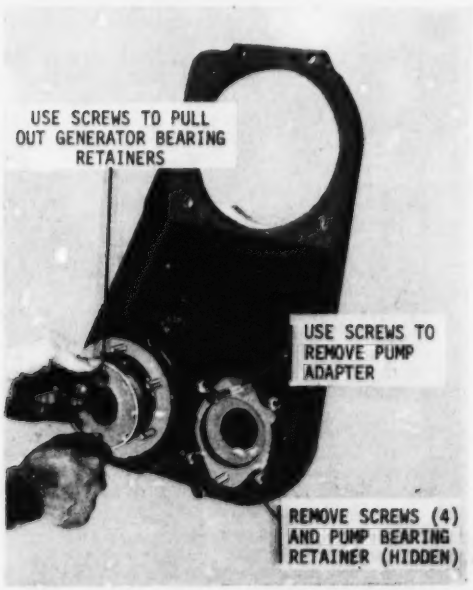
Figure 4-5. Auxiliary power unit—disassembly and assembly (Sheet 5 of 6).



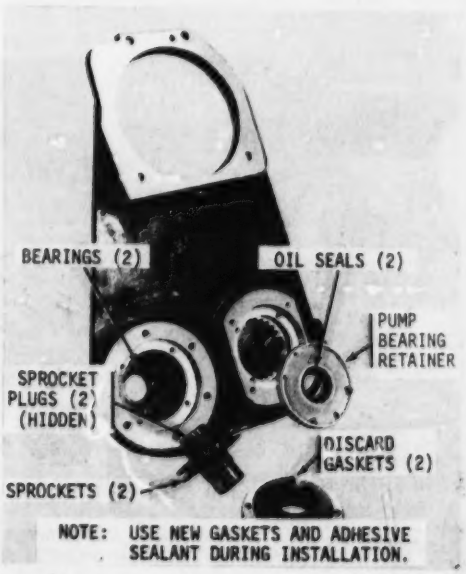
VIEW W. SCREWS AND LOCK WASHERS.



VIEW X. STUDS.


USE SCREWS TO PULL OUT GENERATOR BEARING RETAINERS
USE SCREWS TO REMOVE PUMP ADAPTER
REMOVE SCREWS (4) AND PUMP BEARING RETAINER (HIDDEN)

VIEW Y. BEARING RETAINERS AND PUMP ADAPTER.



VIEW Z. GASKETS, OIL SEALS, SPROCKETS AND BEARINGS.

TA016192

Figure 4-5. Auxiliary power unit—disassembly and assembly (Sheet 6 of 6).

c. Cleaning.

(1) Scrape cork gasket and silicone adhesive from all areas. Clean with a wire brush, then with drycleaning solvent or mineral spirits paint thinner. Dry with compressed air.

(2) Clean dirt and other foreign material from all metal parts with drycleaning solvent or mineral spirits paint thinner. Dry with compressed air.

(3) Remove dirt and other foreign material from electrical leads and connectors with a wire brush and clean water. Dry with compressed air.

d. Inspection and Repair.

(1) *Inspection.*

(*a*) Inspect support, mounts, cooling duct, chain case and chain cover for cracks, distortion and breakage.

(*b*) Inspect threaded parts for nicks, cross threading and other evidence of excessive wear.

(*c*) Inspect drive chain for cracks, breakage and other evidence of wear which could cause breakage.

(*d*) Inspect hose and hose assemblies for fraying, cracks, distortion and other evidence of excessive wear.

(*e*) Inspect sprockets for damaged teeth, cracks, distortion and other damage which would impair their use.

(*f*) Check continuity of electrical leads and inspect for cuts, damaged connectors and other evidence of excessive wear.

(*g*) Inspect panels, gaskets, and grommets on engine for cracks, tears, and hardening.

(*h*) Inspect hydraulic pump, generator and other parts for damage that would impair their use.

(2) *Repair.*

(*a*) Replace support, mounts, cooling duct, chain case and chain cover if not repairable by welding.

(*b*) Repair damaged threads with a thread chaser or replace threaded parts that are defective.

(*c*) Replace damaged lead wires and connectors (fig 3-20).

(*d*) Replace any other parts that are defective.

d.1. Generator/Starter Brush Sanding Procedure. To seat the brushes sufficiently, and eliminate hard-starting problems, when replacing the generator/starter, or its brushes, sand the brushes according to the following procedure.

(1) Remove generator/starter from the auxiliary power unit (View U, fig 4-5).

(2) Remove brush guard band from generator/starter.

(3) Remove screw to brush lead wire.

(4) Move aside brush retainer springs (View B, fig 4-5.2) sufficiently to clear brushes. A screwdriver or stiff piece of wire bent into a hook shape can be used to accomplish this.

(5) Remove both brushes in any one brush set, and insert a piece of sandpaper (about 2″ wide and 180 grit) beneath empty brush holder (View C).

(6) Insert only one brush back into holder (View D), and while pressing down on top of the brush lightly, move it back and forth in the holder, and against the sandpaper until the entire face of the brush is sanded. This only requires about a dozen firm strokes of the brush against the sandpaper.

(7) Replace brush set back into the brush holder.

(8) Replace brush retainer springs on top of brush.

(9) Replace brush lead wire using its respective mounting screw.

(10) Repeat (3) through (9) above for all six brush sets in the generator/starter.

(11) Replace brush guard band.

(12) Replace generator/starter onto auxiliary power unit (View V, fig 4-5).

e. Assembly. Assemble the auxiliary power unit in reverse order of disassembly, applying sealing compound (NSN 8030-00-543-4384) to all pipe threads except swivel fittings. During assembly, apply silicone RTV Type I adhesive sealant (NSN 8040-00-225-4548) to gaskets, aline sprockets and tap or drill hole as required (fig 4-5).

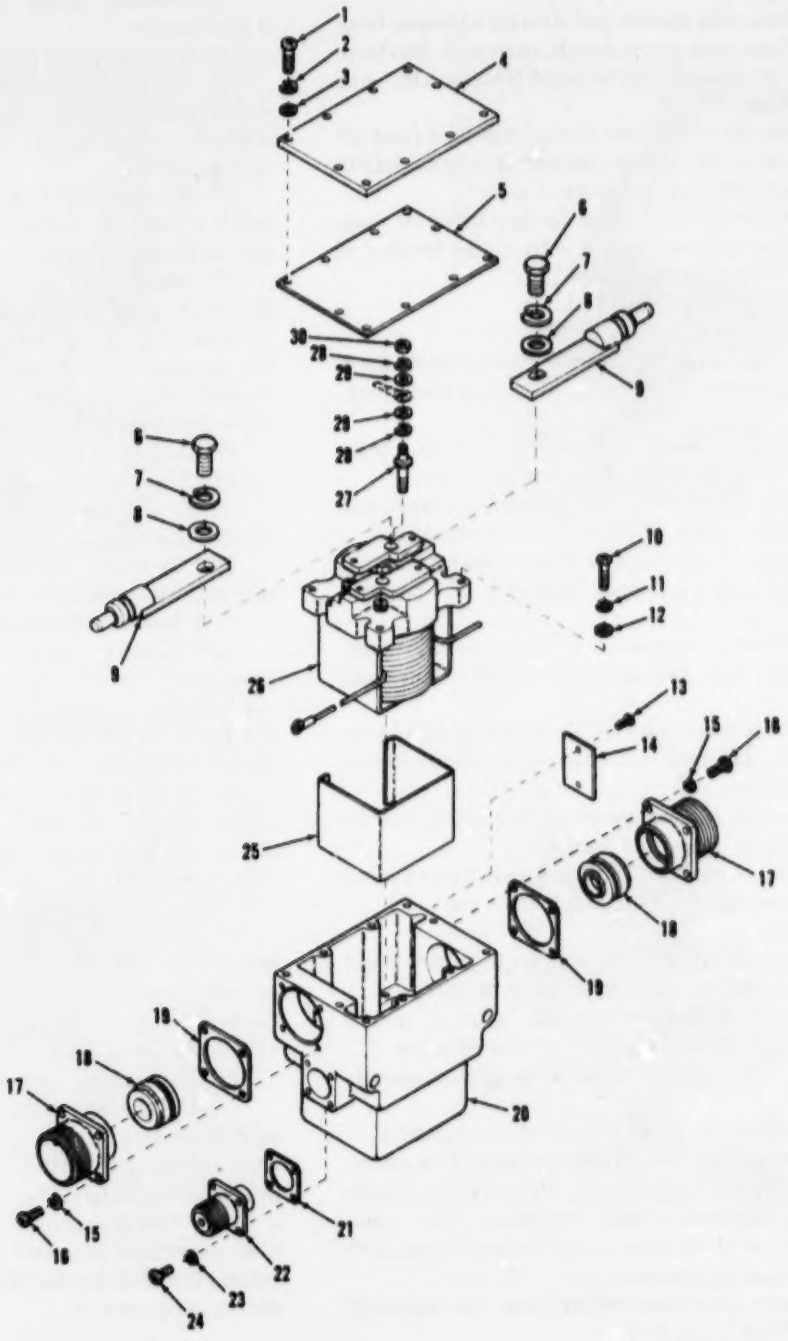
f. Tests and Adjustments.

(1) *General.* All testing and adjusting of the auxiliary power unit must be accomplished with the unit outside the vehicle. A test stand (fig. 4-2) is required. Calibration of the current limiter is to be done in the vehicle. Refer to TM 9-2350-256-20.

(2) *Test outside vehicle.*

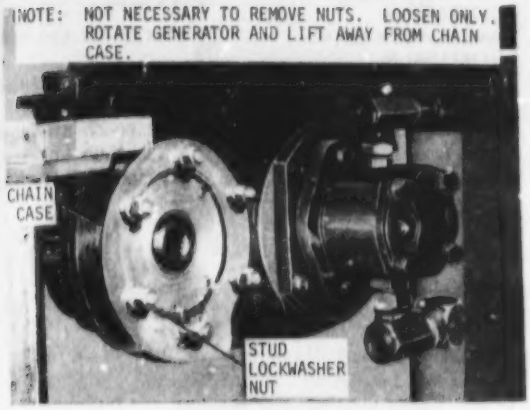
(*a*) Make sure that all lines, cables, accessories and other components are properly installed, tightened and adjusted. Fill chain case and crankcase to the proper levels (LO 9-2350-256-12) if required.

(*b*) Using a ground cable assemblies and seven hose assemblies provided for the test run outside the vehicle (table 2-1), fuel lines and hydraulic system as shown in figure 4-6.

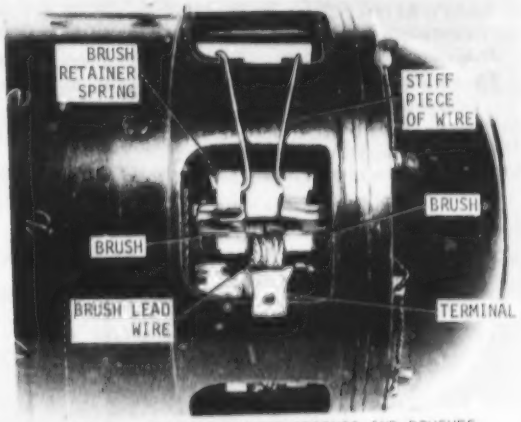


1 Screw
2 Lockwasher
3 Washer
4 Cover
5 Gasket
6 Screw
7 Lockwasher
8 Washer
9 Bus bar
10 Screw
11 Lockwasher
12 Washer
13 Screw
14 Nameplate
15 Lockwasher
16 Screw
17 Shell
18 Insert
19 Gasket
20 Housing
21 Gasket
22 Receptacle assembly
23 Lockwasher
24 Screw
25 Insulator
26 Relay assembly
27 Stud
28 Lockwasher
29 Washer
30 Nut

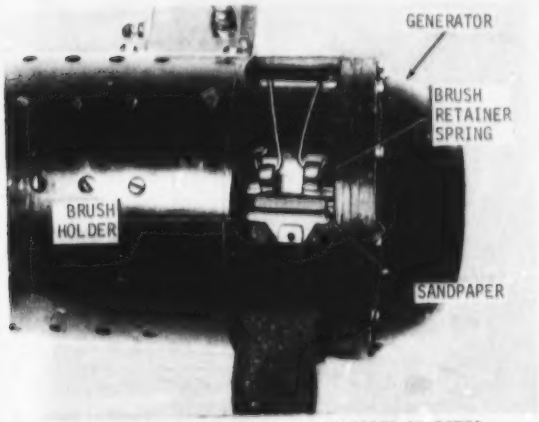
Figure 4-5.1. Relay assembly—exploded view.


NOTE: NOT NECESSARY TO REMOVE NUTS. LOOSEN ONLY. ROTATE GENERATOR AND LIFT AWAY FROM CHAIN CASE.
CHAIN CASE
STUD LOCKWASHER NUT

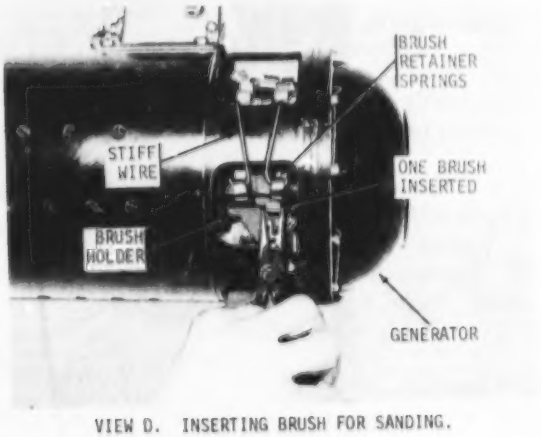
VIEW A. APU WITH GENERATOR/STARTER REMOVED.



VIEW B. BRUSH RETAINER SPRINGS AND BRUSHES.



VIEW C. BRUSHES REMOVED - SANDPAPER INSERTED.

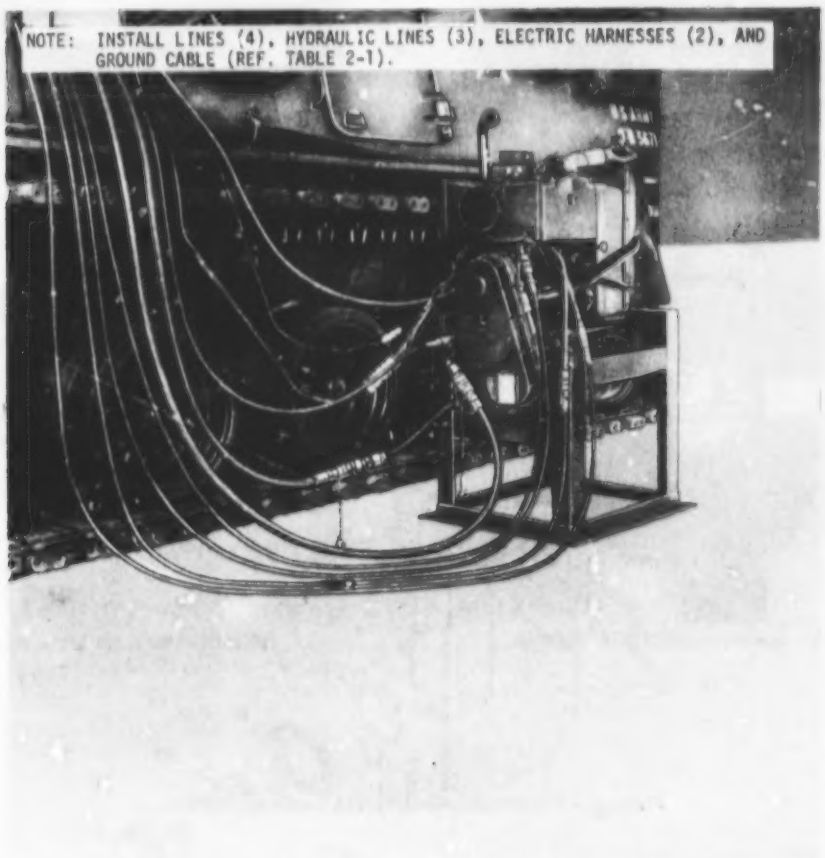


VIEW D. INSERTING BRUSH FOR SANDING.

TA039300

Figure 4-5.2. Generator/starter brush sanding procedure.

1	To APU fuel transfer pump (11671580-1)	NSN 4720-00-617-6929
2	Fuel return (11671580-2)	NSN 4720-00-619-6929
3	From transfer pump to fuel filter (11671580-2)	NSN 4720-00-619-6929
4	From fuel filter to APU fuel injector pump (11671580-1)	NSN 4720-00-617-6929
5	Pump to pressure switch (11671580-4)	NSN 4720-00-619-9689
6	Pump to vehicle system (11671580-5)	NSN 4720-00-619-9681
7	From reservoir to hydraulic pump (11671580-3)	NSN 4720-00-619-9691
8	Wiring harness (11671581-4)	NSN 2590-00-614-7545
9	Wiring harness (11671581-3)	NSN 2590-00-614-7544
10	Ground cable (8708290)	NSN 2590-00-521-6223

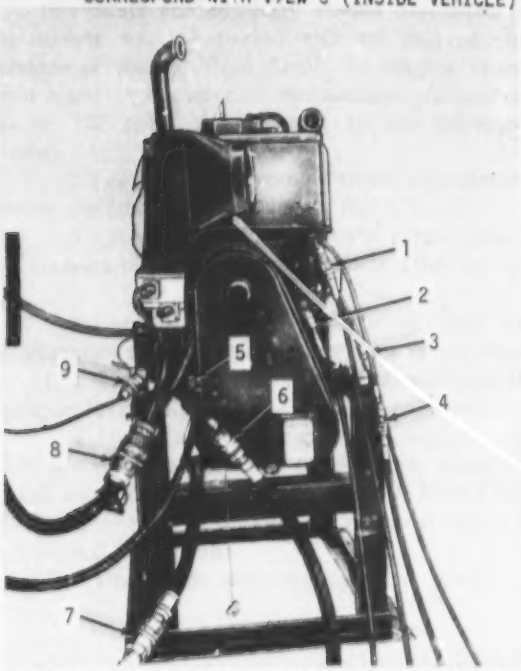


VIEW A. APU GROUNDHOPPING.

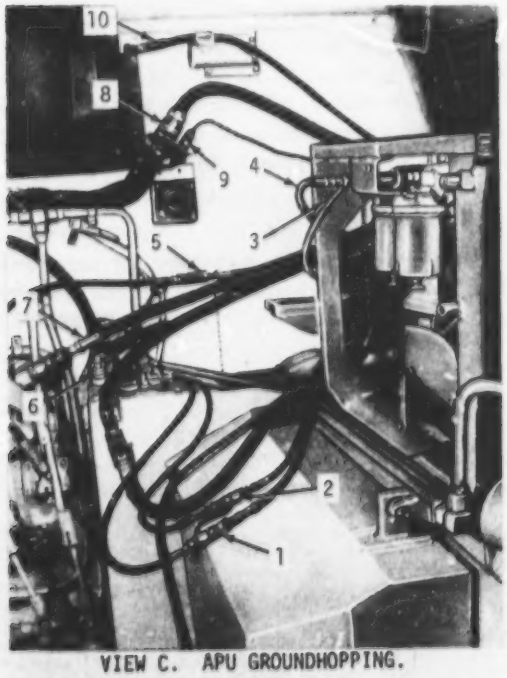
TA016143

Figure 4-6. Auxiliary power unit test run outside vehicle (Sheet 1 of 2).

NOTE: CALLOUTS IN VIEW B (OUTSIDE VEHICLE) CORRESPOND WITH VIEW C (INSIDE VEHICLE)



VIEW B. APU OUTSIDE VEHICLE (ON TEST STAND).



VIEW C. APU GROUNDHOPPING.

TA039301

Figure 4-6. Auxiliary power unit test run outside vehicle (Sheet 2 of 2).

(c) Start the auxiliary engine and allow a three-minute warmup period with no load on the generator or pump. Then check the engine speed with a hand tachometer or stroboscope. Adjust to 2000 ± 100 rpm, if necessary, in the following manner.

1. Locate the governor speed adjustment screw on the front of the engine (3, fig. 4-1).

2. Loosen locknut and turn screw slowly until tachometer or stroboscope reads 2000 ± 100 rpm.

3. Carefully tighten locknut so that the tachometer or stroboscope reading does not change.

(d) Stop engine, check crankcase oil and fill to proper level (LO 9-2350-256-12) if required.

(e) Install a pressure gage in the gage port of the system selector valve on the hydraulic control panel (subplate) assembly (View A, fig. 2-29).

(f) Start the auxiliary engine, place the manual shutoff valve in NORMAL OPERATION position, place the system selector valve in AUXILIARY position. Check the pressure gage to confirm a hydraulic load on the auxiliary pump of 2000 ± 50 psi. Adjust the system selector valve relief valve with the adjusting screw (View A, fig. 2-29), if necessary, to obtain a pressure reading of 2000 ± 50 psi.

(g) Operate the auxiliary engine for 10 minutes with a 2000 ± 50 psi load on the auxiliary hydraulic pump and no load on the generator.

(h) Check all points for leakage (TM 9-2305-256-20) and correct any other defects. Return the system selector valve position to the MAIN position and shut off engine.

(i) Connect a multimeter between the generator armature terminal and ground (set meter on DC voltage mode--50 volt range).

(j) DELTED

(k) DELETED

(l) Turn on the generator switch momentarily and note the generator output voltage on the multimeter. Voltage should increase slightly when the generator switch is turned on. If not, remove the cap from the switching relay box assembly in the vehicle. Loosen the rheostat locking nut and turn the adjusting screw slowly clockwise until the voltage on the multimeter increases slightly. If voltage does not increase, troubleshoot the system.

NOTE

Current limiter rheostat must be calibrated when the auxiliary power unit is reinstalled in the vehicle.

(m) Turn off generator.

(n) Turn off engine.

(3) *Test inside vehicle.*

(a) Make sure that all lines, cables, accessories and other components are properly installed, tightened and adjusted. Fill chain case and crankcase to the proper levels (LO 9-2350-256-12) if required.

(*b*) Start the auxiliary engine and allow a three-minute warmup period with no load on the generator or pump. Then check the engine speed with a hand tachometer or stroboscope. Adjust to 2000 ± 100 rpm, if necessary, in the following manner.

1 Locate the governor speed adjustment screw on the front of the engine (3, fig. 4-1).

2 Loosen locknut and turn screw slowly until tachometer or stroboscope reads 2000 ± 100 rpm.

3 Carefully tighten locknut so that the tachometer or stroboscope reading does not change.

(*c*) Stop engine, check crankcase oil and fill to proper level (LO 9-2350-256-12) if required.

(*d*) Install a pressure gage in the gage port of the system selector valve relief valve, place the manual shutoff valve in NORMAL OPERATION position and place the system selector valve in AUXILIARY position.

(*e*) Check the pressure gage to confirm a hydraulic load on the auxiliary pump of 2000 ± 50 psi. If necessary, adjust the system selector valve relief valve with the adjusting screw (View A, fig. 2-29) to obtain a pressure reading of 2000 ± 50 psi. Check engine rpm for 2000 ± 100 rpm. If engine rpm is below 2000 ± 100, troubleshoot.

(*f*) Continue to operate the auxiliary engine for 10 minutes with a 2000 ± 50 psi load on the auxiliary hydraulic pump and no load on the generator.

(*g*) Check all points for leakage (TM 9-2350-256-20) and correct any other defects. Return system selector valve to MAIN position and shut off engine.

(*h*) Calibrate the current limiter as per paragraph 3-47. With the load applied as stated in step (i) of paragraph 3-47f(3), verify that the engine speed remains within 2000 ± 100 rpm. If not, readjust the governor speed control. If the engine cannot maintain 2000 ± 100 rpm under generator load, troubleshoot.

Section II. DEEP WATER FORDING KIT

4-3. Description

The deep water fording kit, when installed on the vehicle, permits fording to a maximum depth of 8 feet, 6 inches. Refer to TM 9-2350-256-20 for a description of the components comprising the deep water fording kit and instructions for their installation.

4-4. Operation

Instructions for operation of the vehicle with the deep water fording kit installed are contained in TM 9-2350-256-10.

4-5. Repair of Bilge Pump

a. General. The components of the bilge pump electrical system are part of the vehicle electrical system. Instructions for their replacement are contained in paragraph 2-21*e*.

b. Disassembly.

(1) *General.* Refer to TM 9-2350-256-20 for removal and installation instructions. Figure 4-7 with its accompanying legend identifies the bilge pump components which are allocated for disassembly (fig. 4-8).

Legend for fig. 4-7:

1 Gasket (F)
2 Seal (F)
3 Seal cover (F)
4 Seal (F)
5 Impeller housing (E)
6 Woodruff key (F)
7 Lock washer (D)
8 Nut (D)
9 Gasket (C)
10 Impeller cover (C)
11 Inlet screen (B)
12 Inlet flange (B)
13 Lock washer (B, F)
14 Bolt, 1/4 x 3-1/2 hex head (B)
15 Impeller (D)
16 Screw, 1/4 x 3/4 hex head (F)
17 Nut (G)
18 Lock washer (G)
19 Bracket (G)
20 Gasket (G)
21 Screw (M)
22 Lock washer (M)
23 Connector, feed-thru-filter, assembly (M)
24 Gasket (M)
25 Connector adapter (M)
26 Brush cap assembly (A)
27 Packing (A)
28 Brush assembly (A)
29 Commutator end bell assembly (N)
30 Jumper (N)
31 Sleeve, 6-1/4 in. glass (H)
32 Gasket (H, L)
33 Screw (K)
34 Lock washer (K)
35 Stator assembly (L)
36 Sleeve, 3-1/4 in. glass (N)
37 Lock washer (N)
38 Screw (N)
39 Pole (K)
40 Pole insulator (K)
41 Field coil (N)
42 Lockwire (I)
43 Screw (I)
44 Shim plate (I)
45 Snapring (I)
46 Bearing (I)
47 Drive end bell assembly (I)
48 Screw (N)
49 Lock washer (N)
50 Rotor assembly (J)
51 Bearing (J)
52 Thru stud (H)

Note: The letters in parentheses refer to figure 4-8 view.

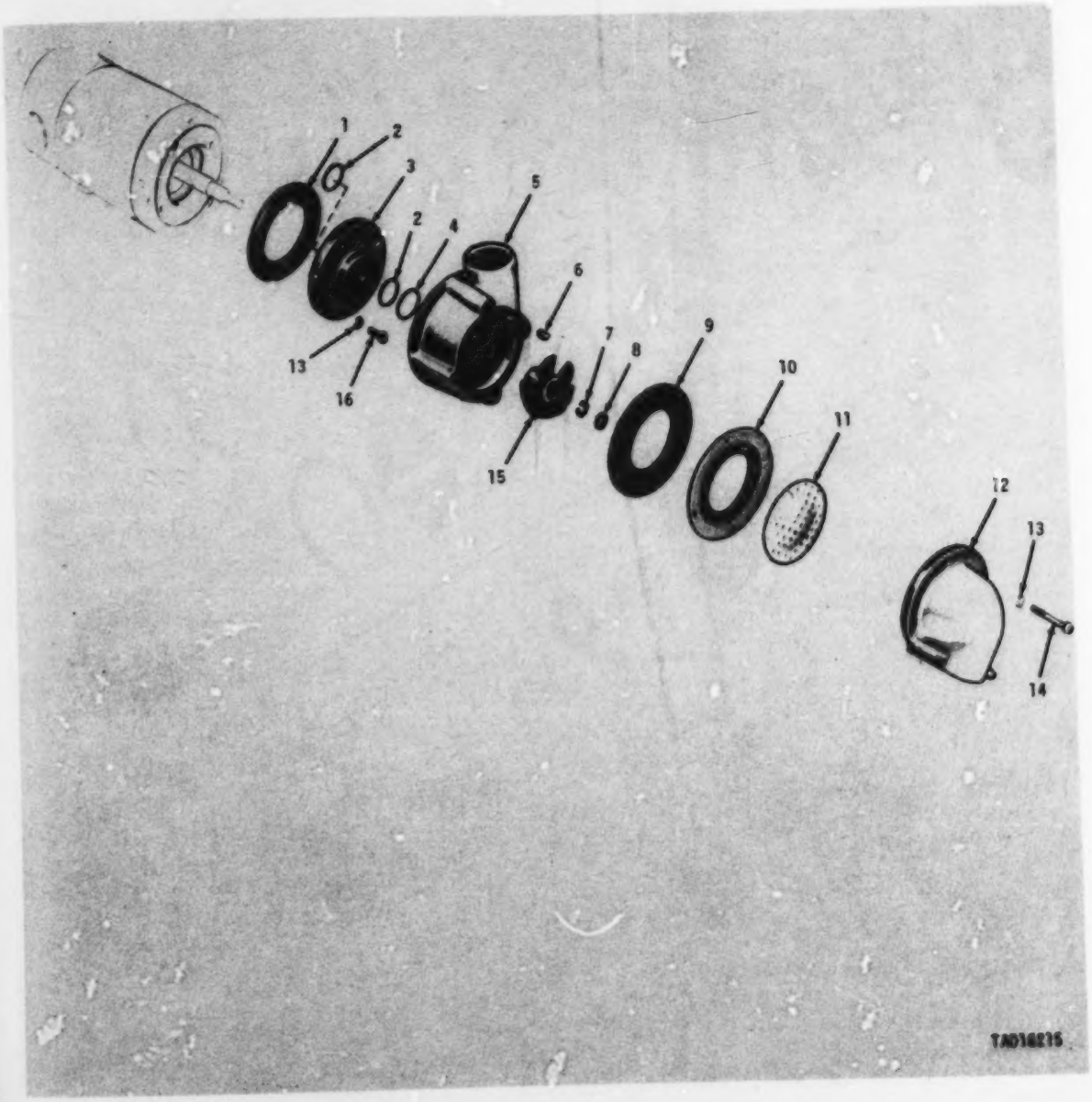


Figure 4-7. Bilge pump—partial exploded view (Sheet 1 of 2).

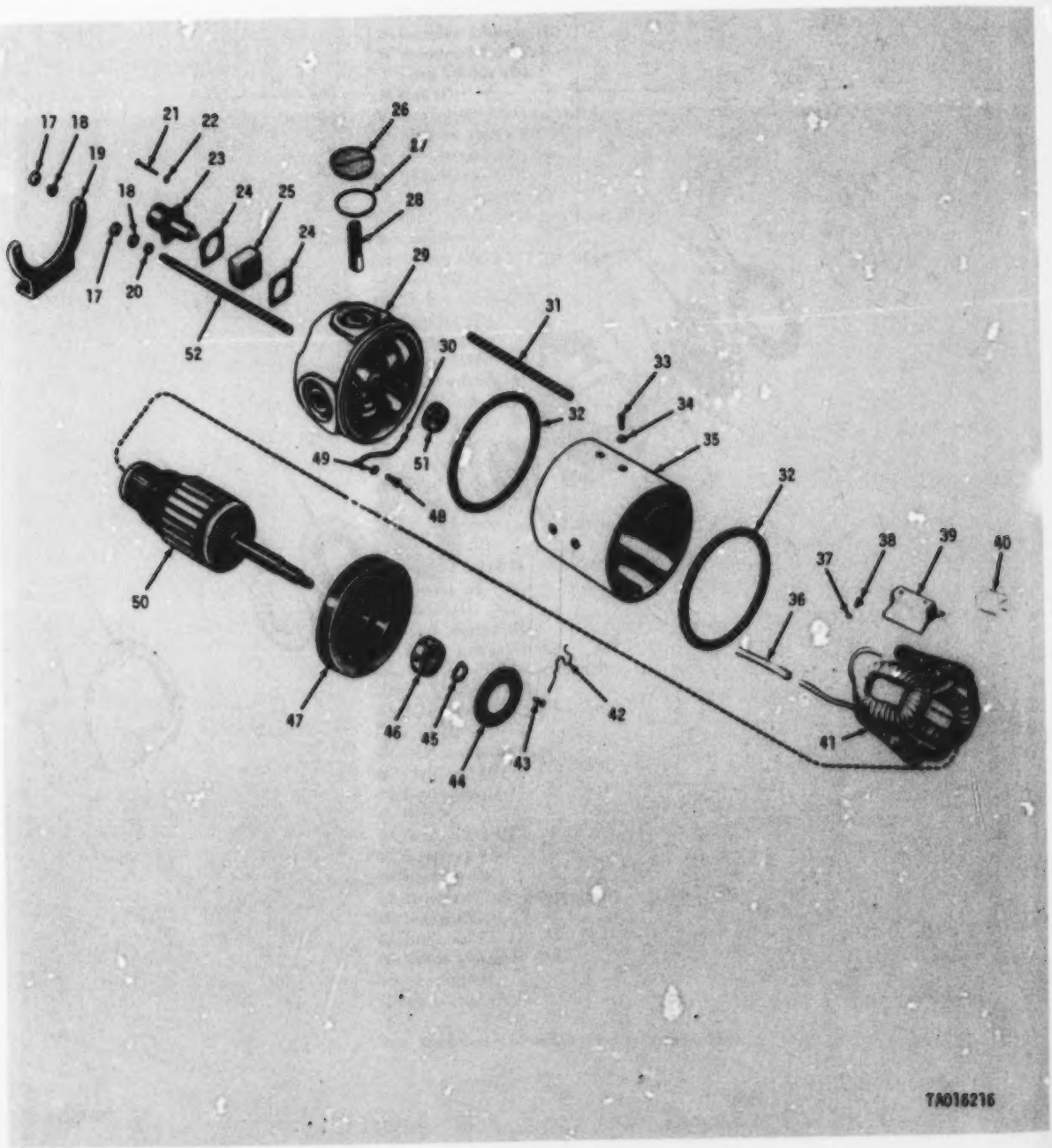


Figure 4-7. Bilge pump—partial exploded view (Sheet 2 of 2).

(2) *Procedure.* Disassemble the bilge pump assembly as shown in figure 4-8.

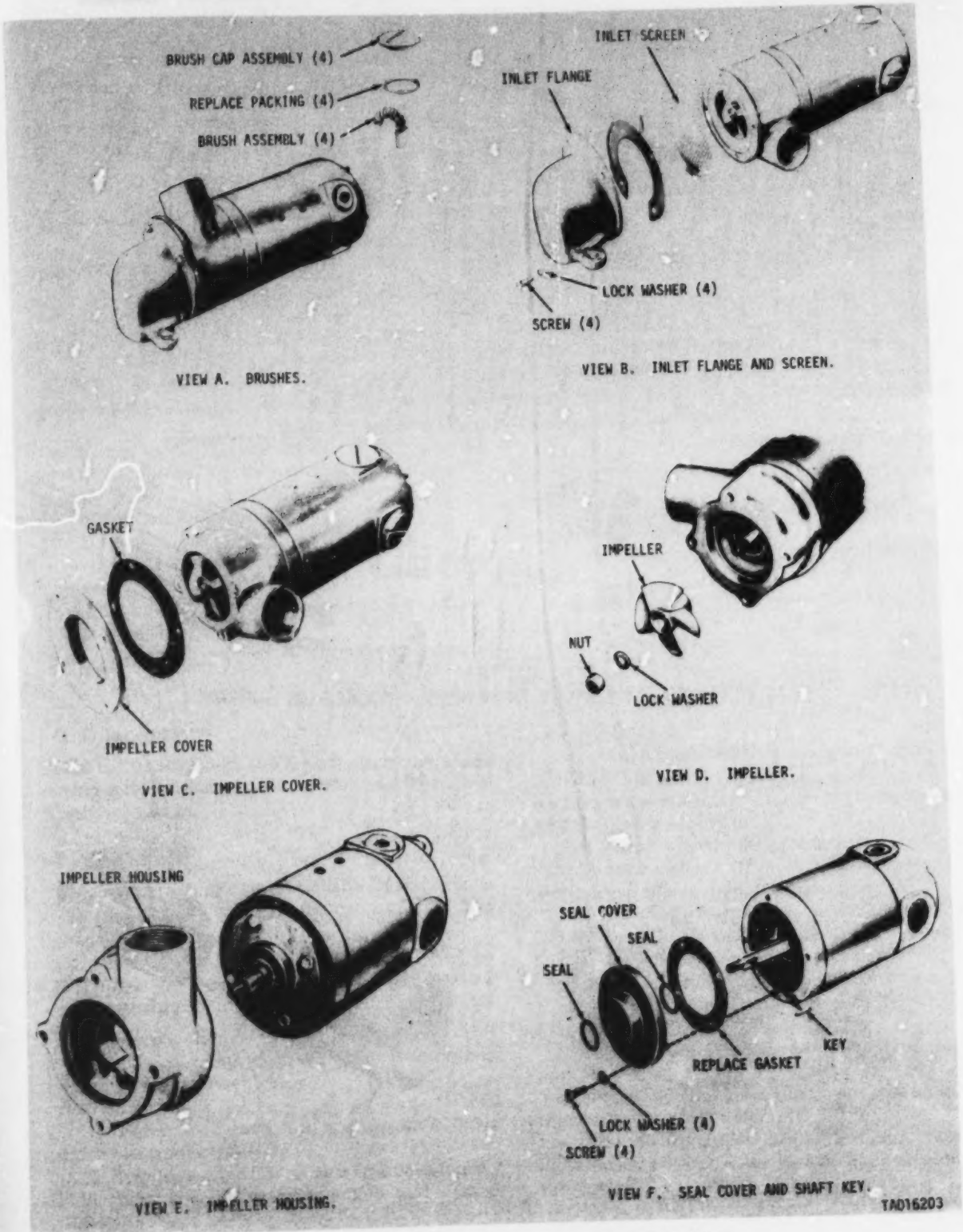


Figure 4-8. Bilge pump—disassembly and assembly (Sheet 1 of 3).

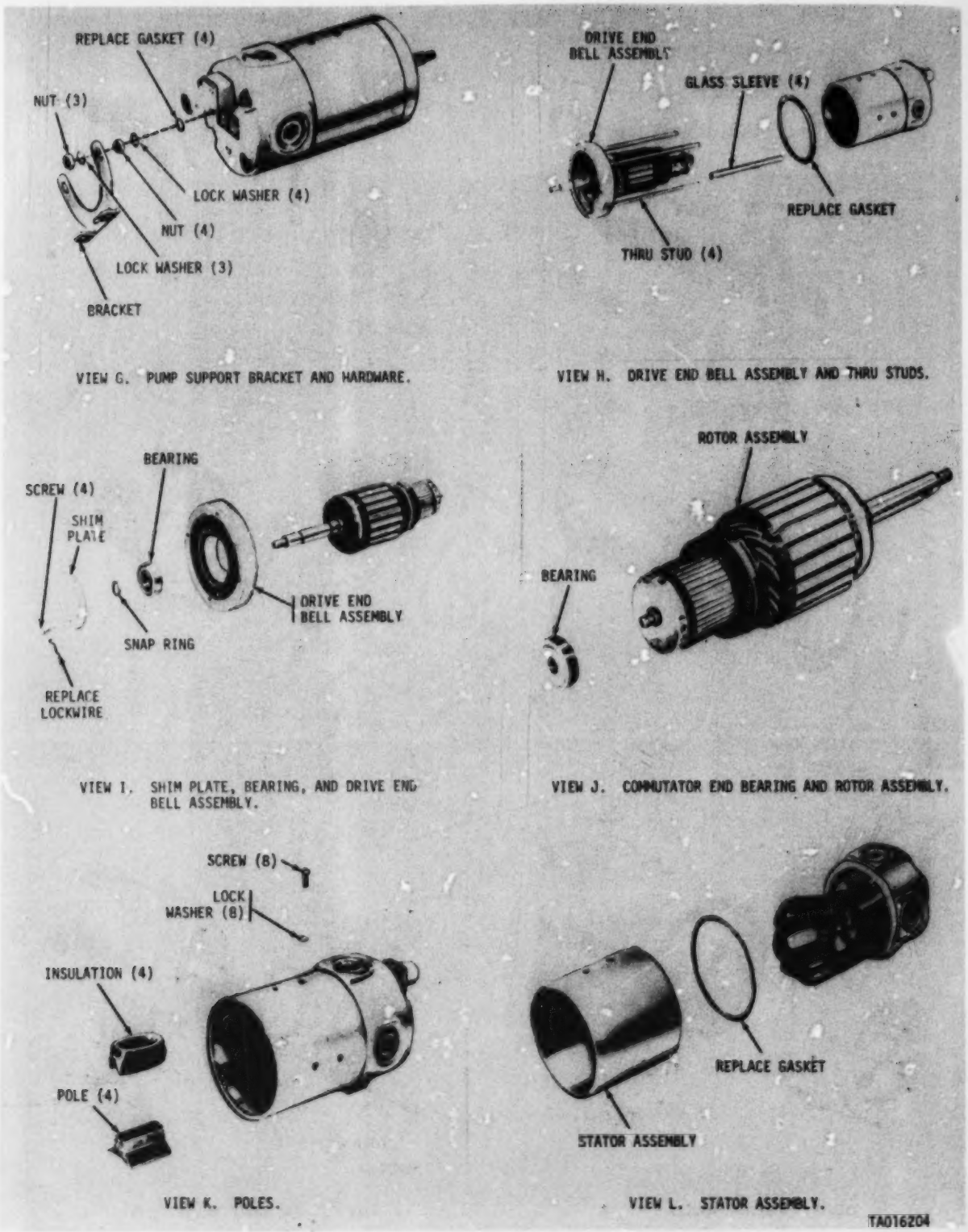


Figure 4-8. Bilge pump—disassembly and assembly (Sheet 2 of 3).

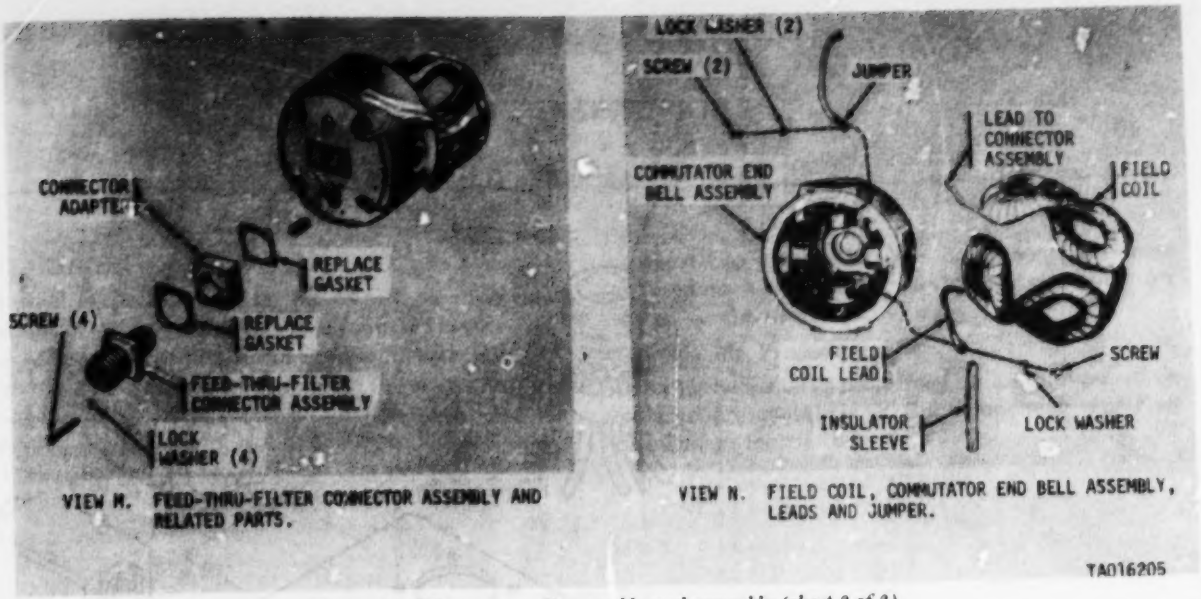


Figure 4-8. Bilge pump – disassembly and assembly (sheet 3 of 3).

c. Cleaning. Clean all parts in drycleaning solvent or mineral spirits paint thinner. Dry with compressed air.

d. Inspection and Repair.

(1) *Inspection.*

(a) Inspect brushes for wear and weak springs.

(b) Inspect inlet screen for distorted and broken wire mesh.

(c) Inspect impeller for damaged blades.

(d) Inspect bearings for score marks and discoloration.

(2) *Repair.*

(a) Repair minor bends in impeller blades or replace impeller.

(b) Replace any other damaged or defective parts.

e. Assembly. Assemble the bilge pump in reverse order of disassembly.

Section III. SMOKE GRENADE LAUNCHER SYSTEM, M239

4-6. Description

Refer to TM 9-2350-256-20 for a description of the components comprising the M239 smoke grenade launcher system.

4-7. Operation

Instructions for operation of the M239 smoke grenade launcher system are contained in TM 9-2350-256-10.

4-8. Repair of Power (Arming) Switch Box Assembly

a. Removal. Refer to TM 9-2350-256-20 for instructions on removal of the power switch box assembly from the vehicle.

b. Disassembly.

(1) Refer to figure 4-9 and remove cable connectors from switch (7).

(2) Remove switch (7) from enclosure assembly (8) by removing two screws (11) and guard assembly (10).

(3) Next remove cable connector from lamp assembly (6), and remove lamp assembly (6) from enclosure assembly (8) by removing two screws (11) and two lockwashers (4).

(4) Remove screw (5) and lockwasher (4) that secures terminal lug (from wiring harness (1)) to ground pad inside enclosure assembly (8).

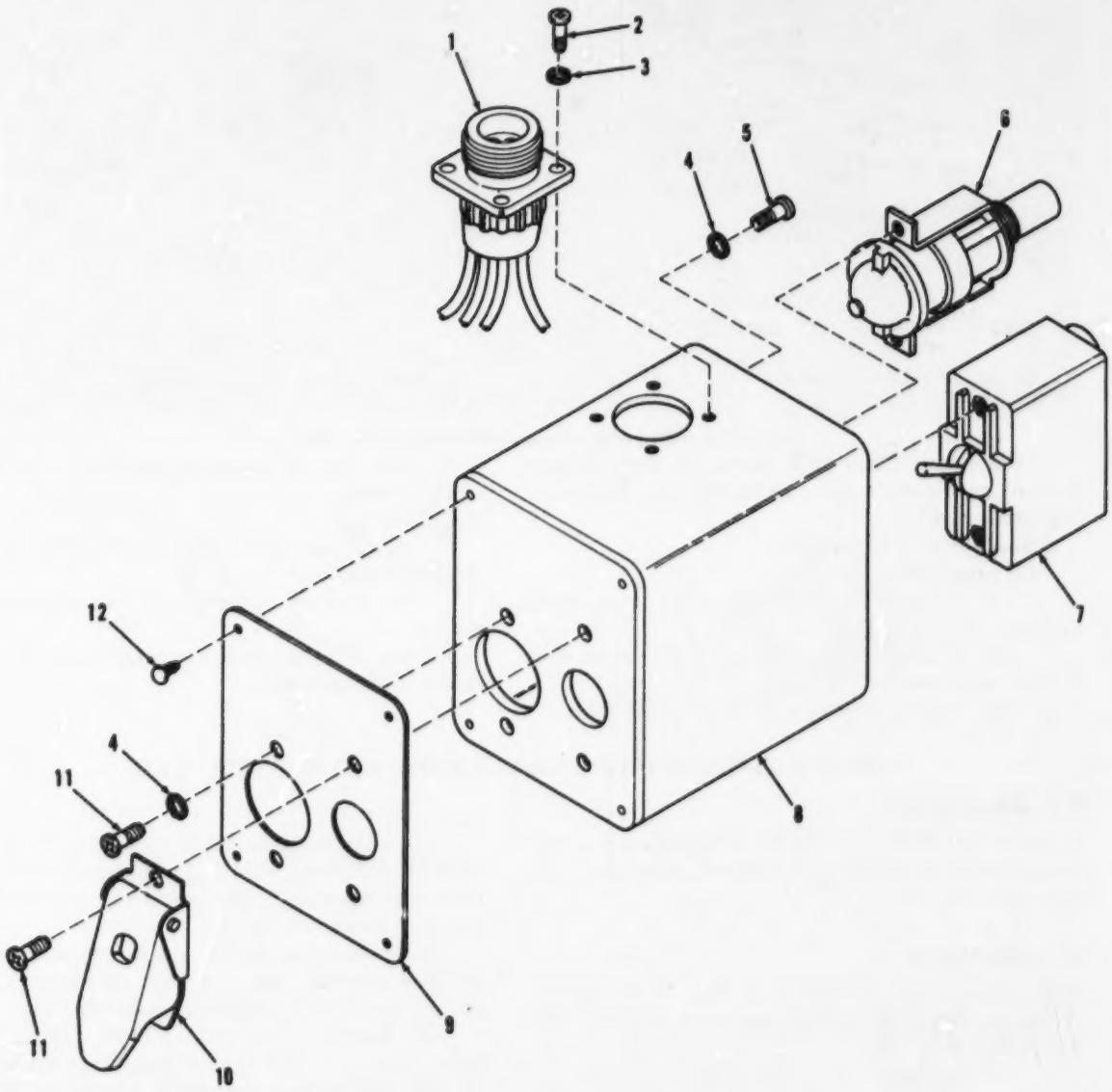
(5) Remove the four screws (2) and four lockwashers (3) that fasten the wiring harness (1) to the top of the enclosure assembly (8), and carefully remove the wiring harness (1).

(6) Finally remove the plate (9) by removing four screws (12).

c. Repair. Replace any damaged or defective part.

d. Assembly. Assemble the power switch box in reverse order of disassembly.

e. Refer to TM 9-2350-256-20 for instructions on installation of the power switch box assembly in the vehicle.



1 Wiring harness
2 Screw
3 Lockwasher
4 Lockwasher
5 Screw
6 Lamp assembly
7 Switch
8 Enclosure assembly
9 Plate
10 Guard assembly
11 Screw
12 Screw

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Figure 4-9. Power (arming) switch box-smoke grenade launcher system, M239 – disassembly and assembly.

CHAPTER 5

FINAL INSPECTION

5-1. General

A final inspection will be performed on all items repaired or replaced to determine whether all necessary work has been accomplished and to determine whether repairs have been performed satisfactorily. This inspection involves visual checks, checks with test instruments, operational checks, safety checks, or any combination thereof necessary to insure that the equipment has been restored to a completely serviceable condition for return to the user or to stock.

5-2. Specific Procedures

Specific checks to be performed on items repaired or replaced are contained in the component repair or installation instructions.

APPENDIX A

REFERENCES

A-1. Publication Indexes

The following indexes should be consulted frequently for latest changes or revisions of references listed in this appendix and for new publications relating to the material covered in this technical manual.

Index of administrative Publications	DA Pam 310-1
Index of blank forms	DA Pam 310-2
Index of DOCTRINAL, TRAINING, and organizational publications	DA Pam 310-3
Index of technical manuals, technical bulletins, supply manuals (types 7, 8 and 9), supply bulletins and lubrication orders	DA Pam 310-4
Index of supply catalogs and supply manuals (excluding types 7, 8 and 9)	DA Pam 310-6
US Army equipment index of Modification work orders	DA Pam 310-7

A-2. Publications Referenced

The following publications are referenced within this manual.

Accident reporting and records	AR 385-40
Recovery vehicle, full tracked: MEDIUM, M88A1 (NSN 2350-00-122-6826)	LO 9-2350-256-12
Elimination of combustibles from interiors of metal or plastic gasoline or diesel fuel tanks	TB 750-1047
Solder and soldering	TB SIG-222
Rigging	TM 5-725
Welding: theory and application	TM 9-237
Operator's manual for recovery vehicle, full tracked: medium, M88A1 (2350-00-122-6826)	TM 9-2350-256-10
Organizational maintenance manual for recovery vehicle, full tracked: medium, M88A1 (2350-00-122-6826)	TM 9-2350-256-20
Direct support and general support maintenance manual for recovery vehicle, full tracked: medium, M88A1 (2350-00-122-6826) winch, power takeoff and hoist system	TM 9-2350-256-34-2
Direct and general support and depot maintenance for transmission, cross-drive assembly (allison model XT-1410-4)	TM 9-2520-215-34
DS and GS maintenance manual for engine with container: turbosupercharged, diesel, fuel injection, 90-degree "V" type, air-cooled 12-cylinder, assembly; models AVDS-1790-2C; 2815-00-410-1203 and AVDS-1790-2D, 2815-00410-1204	TM 9-2815-220-34
Direct support and general support maintenance manual (including repair parts and special tools list) engine, diesel, industrial type, model DJBMA (2815-00-615-8740)	TM 9-2815-221-34&P
Painting instructions for field use	TM 9-2851
Operator and organizational maintenance manual for lead-acid storage batteries	TM 9-6140-200-12
The Army maintenance management system (TAMMS)	TM 38-750

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General, United States Army
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DISTRIBUTION:

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1-11		1-3	
2-7		2-8	

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Line 1. NSN 5330-00-520-8403 should be changed to 4730-00-520-8403.

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Item 3. Should be reversed with item 7.

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THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 Lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

TEMPERATURE

$\frac{5}{9}(°F - 32) = °C$
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
$\frac{9}{5}(°C + 32) = °F$

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621